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- RESEARCH
- DEVELOPMENT
- ACQUISITION

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ABOUT THE COVER:

Each year, under the provision of AR 672-13, the Secretary of the Army may recognize one or more of the Army program/project managers for outstanding accomplishment. Recipients of such awards have received a large engraved plaque, such as those shown on the cover, and an engraved certificate carrying the formal citation, and signed by the Secretary of the Army.

For the year 1978 Secretary Alexander cited two men, BG Edward M. Browne, Program Manager, Advanced Attack Helicopter, and COL Richard D. Kenyon, Project Manager, Blackhawk. (See p. 1 for details.) This was the first instance since the program's inception in 1976 that two awards were made for a single year.

Previous winners of the award were: MG Robert J. Baer (XM1), 1976 and BG Frank P. Ragano (U.S. Roland), 1977.

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9th Annual PM Conference Speakers Continue High-Level Dialogue

The Army's 63 Project and Program Managers, Acting Project Managers, PM designees, and many of the Army's senior officials met for the ninth Annual Project Managers Conference in Orlando, FL, 15-17 Nov. 1978. The purpose was to provide continuance of the annual high level discussion on trends, policies, and problems of the past year in the project management process.

With the growth of national emphasis on enhancing U.S.-NATO cooperation to increase NATO's conventional combat efficiency, the subject of rationalization, standardization, and interoperability (RSI), was a major topic of discussion.

The meeting, which extended over three days of presentations and discussions, was opened by DARCOM Commander GEN John R. Guthrie. Declining to call his remarks a keynote address, the General chose to refer to his talk as topics that were on his mind that he felt were of importance to the group. He began by referring to his notes from the previous year's conference as a point of departure.

He felt that in general, the year had been one of solid accomplishment by DARCOM under trying circumstances. The reorganizational problems of the previous year had some impact on the command's ability to accomplish its mission, but he was pleased with the progress during the year, to where almost all of the reorganizational goals have been attained. The high perception of DARCOM, said Guthrie, was in his opinion, at an all-time high in OSD, largely due to the recently accomplished baseline study. This condition, he remarked, can be maintained only by continuing and constant effort.

The concern GEN Guthrie mentioned last year over the people problems, he noted, was still present. Specifically, the General noted the disproportionate demand by the project management system for high grade, high skilled people. In the light of stretched personnel requirements, DARCOM-wide, the consequent erosion of the technological base by such demands poses a problem.

Complicating the people problem for DARCOM was the hiring freeze and the grade reduction issues. GEN Guthrie noted that he was attempting to seek relief from the grade reduction in light of its potential impact to already existing handicaps in hiring qualified technical personnel.

Better integration of the DARCOM headquarters into its commands' activities has been achieved, said the General—especially in resource management.

Turning to the point of letter contracts that he raised last year, GEN Guthrie was pleased to point out that while the number of such contracts was up, the dollar volume was markedly down, and the time length of such contracts was considerably less. This was a significant accomplishment, in his opinion.

However, he expressed concern over DARCOM's ability to obligate its funds in a timely manner. While the command made great strides in obligating its funds, there were still delays that could result in the government's losing bargaining time to obtain the lowest price.

He commented on his remarks of the previous year concerning the integrated logistic systems—ILS. GEN Guthrie stressed he was still not satisfied with

(Continued on page 17)

2 PMs Praised for Outstanding Performance

Secretary of the Army Clifford L. Alexander cited BG Edward M. Browne and COL Richard D. Kenyon for outstanding performance as program manager/project manager during the period July 77-June 78.

The awards were made as part of the program whereby each year the Secretary may cite a particular PM for his work. This was the first instance since the program's inception in 1976 where two individuals were selected.

BG Browne was selected for his outstanding performance as program manager of the Advanced Attack Helicopter.

His citation reads as follows:

"Secretary of the Army Award for Program Management. Brigadier General Edward M. Browne is cited for outstanding performance as Program Manager of the Advanced Attack Helicopter program during the critical period July 77 through June 78. Through his initiative, technical competence, excellent judgement, and astute managerial ability, General Browne managed and coordinated the activities of a complex multilevel program interfacing AAH, Target Acquisition Designation System/Pilot Night Vision System and 30mm Ammunition while restructuring his overall program to meet directed fiscal reduction and maintaining established performance, schedule, and cost goals during a period of strict personnel and fiscal austerity, an achievement of great distinction. General Browne's performance reflects great credit upon himself, the Advanced Attack Helicopter Program, and the United States Army."

The second citation went to COL Kenyon, project manager, Black Hawk. His citation reads:

"Secretary of the Army Award for Project Management. Colonel Richard D. Kenyon is cited for outstanding performance as Project Manager of the Black Hawk Program during the critical period July 77 through June 78. Through his initiative, technical competence, excellent judgement, and astute managerial ability, Colonel Kenyon has successfully managed the Black Hawk Program through the Advanced Development Phase and into production while remaining within total program funding requirement. on or ahead of schedule and meeting or exceeding all technical performance characteristics, an achievement of great distinction. Colonel Kenyon's performance reflects great credit upon himself, the Black Hawk Program, and the United States Army."

Both awards were made by Assistant Secretary of the Army (RDA) Percy A. Pierre, following the luncheon at the Project Managers Conference, Orlando, FL, on Tuesday, 15 Nov. 1978.



PROGRAM/PROJECT MANAGERS BG Edward M. Browne and COL Richard D. Kenyon, flanked by Assistant Secretary of the Army (RDA) Percy A. Pierre who presented the awards, and DARCOM Commander GEN John R. Guthrie.

Interview With an Army DASC: MAJ Raymond J. Wauford

Since the January 1978 issue, the magazine has been doing periodic interviews with senior persons who are or have been involved, at the policy making level, in the Army's materiel acquisition community. By way of giving a different but equally important perspective to the total picture, it was suggested that an interview be done with a typical Department of the Army System Coordinator (DASC) from the Office of the Deputy Chief of Staff for Research, Development, and Acquisition.



MAJ Raymond J. Wauford and RDA Magazine Editor L. VanLoan Naisawald

MAJ Raymond J. Wauford is one of 68 DASCs on the Army Staff and is currently the DASC for the multi-million dollar Patriot air defense missile system.

Graduated from Vanderbilt University in 1963 with a BS in electrical engineering, he subsequently earned an MS degree from the University of Texas in 1970 in operations research—systems analysis.

Entering the Army in 1963 from ROTC, MAJ Wauford was commissioned in Air Defense Artillery and has served as a Hawk battery officer, as an ORSA specialist with MASSTER, and as an operations officer of a Vulcan/Chapparal battalion.

He completed the Army's Command and General Staff College in 1974. MAJ Wauford was assigned to ODCSRDA as the DASC for the Improved Hawk system, and became responsible for the Patriot system in September 1976.

MAJ Wauford holds the Purple Heart, the Bronze Star, and the Army Commendation Ribbon.

Q. When you were assigned to ODCSRDA did you have any idea of the job to which you would be assigned?

A. Yes, I was informed that I would be a DASC when first alerted for the assignment to ODCSRDA. The Improved Hawk DASC at that time had recently been selected for senior service schooling, and I was reassigned on rather short notice as a replacement. Quite frankly, my understanding of the DASC job and, in fact, the Army staff, was vague at best, based mainly on a couple hours of instructions at Leavenworth.

Q. Did you know you were going to be the Improved Hawk DASC when you came or only that you were going to be a DASC?

A. Yes, I knew I was being recruited specifically for that job, based on my past experiences with the Hawk system.

Q. Had any of your previous military and academic experience related directly toward your duties as a DASC?

A. I have found my past military and academic experience directly applicable to the job. Three years of battery level field experience with the Hawk system proved invaluable in my initial assignment as the Improved Hawk DASC. Issues at that time centered mainly around readiness, product improvements, foreign sales, etc. First-hand knowledge of the Hawk system greatly assisted in understanding these problems and subsequently coordinating Army responses. I suppose my academic background has been most helpful during the past two years as the Patriot DASC. This background in electrical engineering and operations research/systems analysis has assisted in monitoring the technical aspects of the Patriot program and in understanding issues raised by the continuing studies of the system. I feel very fortunate to have had this background and experience to draw from while sorting through issues which generally are complex and confused by technical language and jargon.

Q. I suppose the issues change then depending on how the program moves through its life cycle?

A. As you might suspect, requirements issues are predominate prior to and during concept definition, technical issues during engineering development, materiel fielding issues through procurement and deployment, with readiness and product improvement issues predominating after deployment.

Q. You completed the course at the Command and General Staff College at Fort Leavenworth before coming here. Did your training at Leavenworth give any feel at all on systems development, how the Army goes from a requirement into a hardware development?

A. I understand the course has changed quite a bit since I attended in 1973. The electives program has expanded to include a stronger coverage of research and development and the system development process. My particular class received extensive instruction on the budget cycle but limited exposure to the life cycle management system.

Q. What were your greatest difficulties in your initial months as the Improved Hawk DASC?

A. I guess the management of the workload within available time must be the greatest problem facing any new DASC. It takes a few months before one can begin to sense appropriate priorities for the wide range of issues and staff actions typically encountered. You might say all the wheels seem to squeak at the same decibel level at first. Generally its a matter of quickly sizing up a given situation as to its fundamental issues, and then informing and energizing the respective Army staff elements in seeking resolution. It is difficult to do this initially without wasting a lot of time and becoming desk and telephone bound. In my experience the effectiveness of action officer level coordination in the Pentagon is proportional to the amount of eyeball contact. Very little that is constructive is accomplished on the telephone.

Q. That leads into my next question. In the interview columns that we are doing for the magazine we try to inform the reader audience so that one can better do his job. In your case, what advice would you give a member of the RDA community who might be selected as a DASC? What could he possibly do to prepare himself?

A. Well, as I mentioned before, I believe each DASC encounters a different situation, depending on the system and its stage of development. Hopefully, a new officer would have a current and extensive background in the type of system he

was being assigned to monitor. Any general advice I might offer would concern his philosophical approach to the job. I believe the word coordinator in the DASC title is the key. The DASC job is a position of trust, and it demands absolute objectivity in the "full-coordination" of all viewpoints of issues concerning the system he monitors. He must insure that the Army Staff and Secretariat are fully informed of all aspects of an issue to support ultimate Army positions which are in the best interest of the Army. The DASC shares a more personal position of trust, I believe, with the System Project Manager. He serves as a link between the Project Management Office and the Army Staff. As such he shares detailed knowledge of the specifics of the PM's program. This is particularly necessary, of course, for budget preparation and defense of that budget. The relationship must be an open and honest one and certainly not adversary in nature. The special relationship between the DASC and PM is in no way inconsistent with the DASC's requirement to remain totally objective in coordinating issues on the Army Staff. The only advocacy role that I see that is appropriate for the DASC, is one of defense of Army positions with OSD and subsequently with the Congress.

Q. How does a DASC interface with a Project Manager? Does the PM type program pose any difficulties or differences in duties for a DASC?

A. I believe a close working relationship is essential between the DASC, the PM and the key members of his management office staff. When this is not possible, the DASC should be reassigned to a different program. The DASC must know the detailed status of all aspects of the program in order to effectively respond to the many information needs of the Army Staff, Secretariat and OSD and to defend the budget. In doing so, most information needs within the Pentagon can usually be satisfied without placing disruptive demands on the Program Management Office. Likewise, the DASC must keep the PM fully informed of issues as they evolve on the Project Manager's system. Policy and other key issues require a frequent and open dialogue between the PM and DASC. Routine requirements and information needs can usually be handled quite appropriately with key members of the PMO staff. Proper coordination with HQ DARCOM, in consonance with the PM, is of course, most important to an effective working relationship.

Q. How do you divide your time; what percentage do you spend answering Congressional inquiries, press queries, etc., in relationship to actually "managing" your program?

A. On an average I spend about a fourth of my time on budget related matters, half on systems development issues and the remaining, I guess, on NATO, Congressional, and other Patriot related activities such as providing on-call system information briefings for visitors, etc. Whereas the periodic work associated with the budget cycle can somewhat be planned, most of the other types of requirements occur generally at random.

". . . the management of the workload within available time must be the greatest problem facing any new DASC. It takes a few months before one can begin to sense appropriate priorities for the wide range of issues and staff actions typically encountered. You might say all the wheels seem to squeak at the same decibel level at first"

Q. How are the relationships of DASCs, generally, between themselves, and DARCOM and TRADOC? Are there any unnecessary areas of overlays?

A. The relationship among the DASCs and their counterparts is excellent and is built on respect for each others respective responsibilities. I guess it can be summed up in the fact that I have never gone to anyone on the Army Staff who didn't



have time to listen to my problem, and in turn I am never too busy to talk to anyone with a question related to Patriot. This gets back again to the value of "eyeball" contact I mentioned earlier. By working together, the DASC and his counterparts are able to address complex problems quickly as they occur. Action officers on the Army Staff are collectively some of the finest people I have ever worked with. Each DASC has points of contact in each Army Staff element. These points of contact work just as hard as the DASC in trying to reach timely resolutions to problems. Because of the close proximity to DARCOM Headquarters, we are able to directly coordinate issues with points of contact there on a daily basis. Unfortunately, TRADOC Headquarters is a bit farther south, and most coordination is done during periodic visits or over the telephone. The activity of each DASC is coordinated and approved at the division and directorate level within ODCSRDA to insure a cohesive Army program. I don't believe there are any unnecessary areas of overlap within this arrangement within the Army Staff or with DARCOM and TRADOC.

Q. Has there been any change in emphasis on program management since you first became a DASC in 1976?

A. No, I can't say that I have sensed any significant changes. I believe there is an increased awareness that the Army is on the verge of a period of major modernization. This can only lead to increased emphasis on program management and the materiel fielding aspects.

Q. Has the recent emphasis on RSI had any major impact in your workload?

A. Yes, it certainly has, and rightly so. All NATO related activities have increased significantly during the past two years. In the case of Patriot this has taken the form of NATO Study and Project Groups which are studying the acceptability of Patriot as a replacement system for European systems—the European Nike Hercules and Hawk. I believe Patriot typifies a common challenge we now face with many of our new systems. Its ultimate adoption by NATO nations will depend on our ability to cooperate together and work out an equitable European acquisition arrangement as well as on the operational considerations. Recent NATO efforts have produced a Memorandum of Understanding which should lead to determination of such an arrangement for Patriot within two years.

Q. Is NATO looking at Patriot in terms of buying it entirely off the U.S. shelves or coproducing or trying to come up with a system that would provide for the consumable aspects? Can you tell us what direction the NATO studies for Patriot are heading?

A. It certainly appears to be in the best interest of NATO that Patriot be standardized as the replacement for current NATO Nike Hercules and either replace or at a minimum be interoperable with NATO Improved Hawk. In consonance with that view, our efforts have been to encourage and assist the European nations in determining a European production arrangement which is most suitable to their acquisition of the system. During the past years, four different options have surfaced that typify the span of different alternatives available to them. On one end of the spectrum would be direct purchase from U.S. production; at the other a license arrangement similar to our planned acquisition of Roland. Improved Hawk and F-16 type options offer alternatives between these two. We are now entering into a two year effort to look at these op-

(Continued on page 4)

Interview With an Army DASC

(Continued from page 3)

tions and determine an arrangement which will be economically and politically acceptable to the Europeans and permit NATO standardization of the system. From where I sit as the DASC, the ultimate challenge to NATO (and the U.S.) lies with our resolve to seek and achieve economically and politically acceptable arrangements which will permit continued modernization of NATO forces in order to meet the massive Soviet threat. I believe we are heading in the right direction.

Q. Do you believe today's DASCs are able to carry out the job as it was originally intended?

A. I believe the DASC can do the job effectively. He must remain informed, objective and believe in the Army Staff concept with its respective division of responsibility and functions. As a coordinator, he must insure full coordination of all viewpoints for quick resolution of issues. With an understanding project manager, he can effectively monitor the program and defend its budget.

Q. What do you find most satisfying in your assignment as a DASC?

A. I guess my satisfaction with the job stems from the outstanding people that I work for and with on a daily basis—that combined with a meaningful job in which I am able to see actions through, from start to finish, is most rewarding.

Q. What do you find is the most frustrating aspect of your DASC job?

A. Well, I suppose that frustration is a relative thing depending on where you sit. As a DASC I find the ease with which Army and OSD analysts and staffers can continually rehash technical issues previously decided by the ASARC and the DSARC to be the most frustrating. Invariably, these redundant challenges waste valuable time and produce little constructive results. I am not referring to the budget process and the continuing review that the Army programs undergo. I believe this is most valuable and a program should not be funded from the Army's scarce resources unless it can stand the



scrutiny. However, technical aspects of programs are reviewed in detail by the ASARC and DSARC process. It seems appropriate to accept ASARC and DSARC decisions on these technical issues and concentrate efforts on policy matters and the demands of the budget process to optimize Army and DOD capability within available funding resources. Of course, the cause for frustration lies with the time wasted; certainly an exacting facet to what is otherwise a super and fun job.

Roland Does Well in U.S./European Test Program

U.S. Roland, the Army's new foreign-developed but American-built air defense system, has passed the most critical portions of the joint European-U.S. test program. Nearing completion to prove out the system, the tests "have gone remarkably well," said BG Joseph O. Lax Jr., U.S. Roland Project Manager at Redstone Arsenal, AL, "which proves that the transfer of European technology to this country has been successful."

Lax said the Army, Hughes and Boeing have built four fire units, produced more than 100 missiles, and have conducted extensive contractor and government tests demonstrating that U.S. Roland meets Army requirements and is compatible with European hardware.

"We have achieved excellent missile reliability in flight tests at White Sands Missile Range," the General said, "and we encountered no major problems in road tests at Aberdeen Proving Ground."

Of 45 flight tests at White Sands, 34 were completely successful, 5 were partial successes, and 6 unsuccessful. The supersonic missiles were launched against computer-simulated targets, Firebee drones, helicopter drones, and unmanned F-86 and F-102 fighters.

Some targets, flying at altitudes ranging from 200 to 9,000 feet, performed evasive manuevers. In one test, a single fire unit successfully engaged two targets only seconds apart.

One of the advantages of Roland is the ability to operate day or night, and in any weather. White Sands tests included firings when the gunner could not see the target, relying on radar for tracking. Two other firings were made in light rain.

Approximately 100 French and German soldiers and civilians, bringing their own fire units, missiles and support equipment to White Sands, have participated in the joint test program and all three countries will share test data.

American missiles have been fired from French and German units and American equipment has fired European missiles.

Early in the test program, crews from Hughes and Boeing performed many of the tests but Fort Bliss, TX, soldiers have just concluded operational firings, including several under "no warning" simulated tactical conditions.

Another Roland advantage, especially important to mobile units, is the surveillance radar's ability to detect and identify aircraft while on the move. At Aberdeen, the radar was operated while the fire unit was moving along a jolting track.

U.S. Roland's fire unit experienced no major technical problems in the more than 1,200 miles of tests which included rough road, maneuverability, braking, noise level, safety and impact of railroad switching tests, along with air lifts by helicopters to demonstrate transportability.

The Army has moved men and equipment to Vandenberg Air Force Base, CA, for additional mobility and tracking tests, including adverse weather and countermeasures environments.

Kent Taylor is chief of Roland Product Assurance and Test Division and Raymond Ginocchio was field office representative for the test program at White Sands.

DARCOM Establishes Battlefield Automation Management Office

Establishment of an Office of the Associate Director, Battlefield Automation Management of Army Defense Systems has been announced by the Development and Engineering Directorate at HQ U.S. Army Materiel Development and Readiness Command, Alexandria, VA.

COL Joseph G. Mikula, who has been appointed as acting associate director of the new office, has been directed to concentrate on several ongoing, high-priority efforts related to automation interoperability. Mr. John Nicholas has been detailed as technical administrator.

Created primarily from the former Development Team for Tactical Computers, the new office will respond to new initiatives on a very selective basis until additional resources become available. The Autovon telephone number is 284-8117, and the office symbol is DRCDE-C.

COL Mikula was DARCOM development manager for Countermeasure/Counter Countermeasures and acting associate director for Foreign Science and Technology.



COL Joseph G. Mikula

NARADCOM Reports on New 'Tasty' Liquid Food Items

Sipping chicken cacciatore or beef burgundy through a straw may not sound like a gourmet treat to most people, but to an accident victim hospitalized with wired jaws, it's heavenly.

The U.S. Army Natick (MA) Research and Development Command has reported development of a variety of specially prepared tasty food items to relieve the monotony of standard hospital liquid diets. Some favorites include sloppy joes, beef with spaghetti sauce, beef stroganoff, chili and pork and beans.

Usual diets for patients who are unable to chew consist of egg nog, a milk shake/soy product or blended and strained table food. The problem with the usual diet is that during the six to eight weeks of being wired, patients often tire of its bland or too sweet taste and refuse to eat.

Natick's new liquid diet is specially processed into less than one half millimeter particles and frozen in eight ounce servings, according to Carol Shaw, a food technologist at the Natick research installation. Frozen servings are then easily thawed, heated for serving and sipped through a straw by the patient.

Several problems had to be overcome in developing the liquid diet. Particles in the drink could not be very large because patients with wired jaws are not only unable to chew, but also are unable to brush their teeth, says Ms. Shaw. Particles also had to be kept in suspension because patients lose the nutritional value of food left in the bottom of the glass.



NARADCOM employe Vicki Loveridge sips a new liquified diet, which includes suspended solids, developed at the Natick Food Engineering Laboratory for patients with wired jaws or those unable to chew foods.

"Most important," says Shaw, "is that the food be spicy and interesting." Even the texture has been varied so that ham and pineapples are a different consistency than the ham and cheese fondue meal.

What will be the effect of the new liquid diet on patients? Ms. Shaw says that she expects patients will "eat more and be better nourished." The liquid is more nutritious than intravenous feeding and is well-liked by patients.

A supply of liquified meat meals will be served shortly at Walter Reed Army Medical Center, Washington, DC. The rest of the menu, including liquid vegetables, potatoes and desserts, is also being developed at the Natick R&D Command.

Research and development of nutritious and tasty liquid diets is reportedly being done only for Walter Reed by Natick Army Research Labs. The Natick R&D Command will share their findings with hospitals and other interested members of the public.

Army Plans Test Production Of New Protective Equipment

The Department of the Army has announced that it will soon begin test production of a new combat helmet and an improved ballistic vest. Both have been field tested and reportedly represent the first major change in combat protective equipment in more than 40 years.

Under development for five years, the helmet contrasts dramatically to the current M-1 helmet. It is designed to provide 25 percent more protection, fit better, and be more comfortable. The new one-piece helmet will be constructed from resin and high-strength synthetic fibers.

The new improved protective vest has been designed to provide the soldier with 50 percent more protection than the current vest. It is made of the same high-strength synthetic fibers as the helmet.

Both items have been designed as a "system" assuring that they work together in all possible positions a soldier assumes in combat. Additionally, the Army performed studies to assure maximum coverage of the head and other vital body areas when the soldier is in a climbing or crawling position.

The Army's program to develop the new protection system was managed by the U.S. Army Natick Research and Development Command, Natick, MA.



Reaching Our Reader Audience

For the *Army RDA Magazine* to carry out its stated missions, it is critical that the distribution be properly matched to the Army materiel acquisition community. The magazine staff has been aware that there have been some gaps in our distribution. This past year steps were begun to correct the weaknesses, and we expect that starting with the 1979 issue, this will be accomplished.

However, there will still be areas where the magazine staff will have no direct control. These will be in the cases of bulk distribution to an installation and activity. This is controlled by The Adjutant General's Office, based upon requisitions submitted by the installation or activity on the DA Form 12-5. The Form contains a formula for computing the authorized number of copies, depending upon grade and number. The magazine staff has received complaints from time to time, that not enough copies are received. Our reply must be that the installation or activity Form 12-5 be reviewed with the local publication officer with the view to making necessary changes.

A lesser number of copies go out on an individual basis, and this is where the staff has made a major change. As a matter of policy, when the magazine was first established, every military member of the former R&D career field was authorized to receive an individual copy. The mailing addresses of everyone in the R&D career field were maintained by the old Office, Chief of Research and Development, and this list was used by the magazine to forward individual copies.

However, the DA Staff reorganization of the early 1970s and the revisions to the Army officer personnel career programs resulted in the termination of the R&D career field and the old OCRD list. The extremely small magazine staff attempted to maintain a current mailing list, but disconnects developed. Then, with the subsequent reorganization of the Army materiel acquisition community to include procurement, as well as R&D, the addition to the list of names of officers carrying Specialty code 97 (Procurement) made it impossible for the magazine staff to handle manually.

Accordingly, we began investigating ways to automate our mailing list which consists of three major parts: the Form 12-5 bulk shipments; the list of active officers carrying the Specialty codes 51 (R&D), 52 (Atomic Energy), 97 (Procurement), and 6-T (Project Manager); and Reserve personnel carrying MobDes assignments in these categories.

Thanks to the fine cooperation of a number of agencies, we expect to begin a computerized mailing, starting with the January-February 1979 issue. In this manner we expect, with the help of the Officer Military Personnel Center, to keep the list of individual names and their duty station current. We will be eliminating invalid and incorrect addresses as well as insuring that the magazine reaches those who are authorized to receive it.

We are grateful for the many suggestions we received on this subject on the Reader Survey cards, and we will keep trying to better serve the Army RDA community.

Explosives Unit Personnel Stress Safety Aspects

In a high risk business where one may not get a second chance, the rule is to be methodically careful the first time. That's the name of the game for Aberdeen's Materiel Testing Directorate's High Explosive Loading, Destruction, and Recovery Unit.

Douglas Holbrook, explosive test operator foreman, recognizes the dangers to the unit's 14-man civilian force, but he feels that by stressing established procedures the unit can minimize the dangers, and the safety record of the unit bears him out. "The work. . .we do here is hazardous, but it's not overly hazardous for those who know what they're doing and follow the standard operating procedures. . . But in addition to the SOP's," Holbrook continued, "we have to develop a feel for what we do."



SAFE FROM DANGER, APG explosive test operator Clarence Adams monitors disassembly of a munitions round from behind a 3-foot reinforced concrete wall where he could activate an emergency deluge system.

The unit's mission includes the examination and inspection of all stored ammunition at Aberdeen (MD) Proving Ground, preparing all ammunition for test firings, hot melt loading of rounds, manufacturing and pressing of pellets, modifying test rounds, disassembly of ammunition for analysis of malfunctions, conducting the annual clean-up of firing ranges, analyzing foreign ammunition, and preparing rounds for display and training.

Part of the job is done in the field using protective devices, and part in the confines of their protected areas of Building 700, the High Explosive Plant.

At the plant, much of the actual disassembly is done by machine, once the explosive has been hand emplaced in the machine. The actual machine disassembly is then observed by closed circuit television from behind reinforced concrete walls three feet thick. Construction is such that the force of any explosion will be directed away from the interior hallway where the monitors are located. Installation of a video tape system also is planned within the next six months.



PROTECTED inside a tank with an extension controlled from within, personnel place a demolition charge near a 105mm HEAT projectile, as part of the units mission of detonating dangerous ammunition.

In field operations such as the annual clean-up, surface ammunition is either detonated in place or removed to the demolition field for destruction.

Safety and caution are and must be the constant companions of the High Explosive Loading, Destruction, and Recovery Unit.

New Process May Improve Turbine Wheel Longevity

The life of turbine wheels in Army helicopter engines has been limited, in some cases, by low cycle fatigue of the wheel rim. Wheels must then be replaced at great expense and with loss of service availability of the helicopter.

To overcome this problem, the U.S. Army Materials and Mechanics Research Center, Watertown, MA, in conjunction with the former U.S. Army Aviation Systems Command, contracted Case Western Reserve University to scale-up a laboratory process to control the microstructure and, therefore, the mechanical properties of alloys typically used in integrally cast turbine wheels.

A process was developed in cooperation with Detroit Diesel Division of General Motors Corps., to refine the grain size in a T63 turbine wheel. This process recently reported on by AMMRC metallurgist Perry R. Smoot, resulted in a remarkable refinement of the grain size from approximately .250 in. to .004 in. (see photograph) and an improvement in the low cycle fatigue properties of the wheel.

It has been successfully transferred to commercial practice utilizing the facilities and personnel of the Howmet Corp. A patent on the process has been applied for.

Also, says Smoot, it can now be considered as a much less costly alternative to the forging and machining process. Engine manufacturers are considering grain refinement as a method for improving the properties of turbine wheels.

Further control of the microstructure in the blade region appears possible and would be desirable for improving stress rupture resistance of the blades beyond that of the original wheel.



Conventionally Cast and Grain-Refined Turbine Wheel Segments

MERADCOM Lays Foundation For New Camouflage Building

The U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, has laid the foundation for a new $1.6 million facility to house the Army's lead laboratory for camouflage research.

The building will house laboratory shop space, offices, conference rooms and other specialized areas. These facilities will allow for research and development in such diverse areas as reflecting radar camouflage, thermal camouflage, decoy construction, camouflage detection and image processing.

Since there are no industrial facilities for this type of research, the new lab will reportedly fill a vital Army need. The current research work at MERADCOM is being done in four separate buildings, but the new building will allow the Army's camouflage program to be expanded and carried out under one roof.

The Camouflage Laboratory is one of eight at MERADCOM, engaged in research and development in four major areas: barrier and counter-barrier systems; countersurveillance systems; energy/environmental systems; and supply distribution/construction equipment systems in support of a mobile Army.

TECOM Installations Test Solar Panels Viability

Will the chimney sweeps of yesterday be reincarnated in the 21st Century as solar panel sweeps? A project thousands of miles from your roof may one day provide the answer.

At the U.S. Army Tropic Test Center, Panama CZ, four solar energy panels have been placed in a fenced-off jungle meadow to test their resistance to tropical heat and humidity. Scheduled to run until 1987, the test concludes its first year this month. It is a joint project of the U.S. Departments of Energy and Defense.

A subordinate activity of the U.S. Army Test and Evaluation Command (TECOM), the Tropic Test Center was chosen for its climatic location and technical capabilities. The Army's principle development tester of weapons and combat gear, TECOM has eight other installations and activities in the United States.

CPT Richard Skaaden, test officer, describes the climate in the Canal Zone as more consistent than extreme. On a recent autumn afternoon, while he checked a new resistor on one of the panels, the sun shone and the temperature was in the eighties—a typical Panama day. Rain comes at regular, frequent intervals, about 80″ a year.

Despite the warm, wet climate, visual inspections and voltage readings indicate that the panels are holding up well. "But it's a little too early to tell what they'll look like in nine years," says Skaaden.

While the elements have not disturbed the panels, Skaaden sometimes discovers that intruders have gotten to them by scaling, squeezing through, or even tunneling under the protective fence.

But these "saboteurs" are not sooty-faced commandoes. The enemies that bedevil the test officer are insects, rodents, and birds that find the 2-foot by 2-foot panels, honeycombed with circular solar cells, a pleasant place to rest. These trespassers are harmless, but industrious. "We found a mouse building a nest in there the other day," says Skaaden.

Unlike the panels atop an estimated 30,000 homes and offices in the United States, the equipment at the Tropic Test Center is photovoltaic. It converts the sun's rays into electrical current. More commonly-used thermal panels use liquids warmed by the sun to heat buildings and water.

Although far more versatile than thermal systems, photovoltaic panels presently are too expensive to produce for anything but experimental use. Their most significant function so far has been to power satellites. However, bringing the cost and application of photovoltaic systems down to earth is one of the objectives of the project at the Tropic Test Center.

Other TECOM installations testing solar panels include the Cold Regions Test Center, Fort Greely, AK, and Dugway Proving Ground, UT. Also conducting tests are the Facilities Engineering Directorate, Fort Lewis, WA, and two U.S. Navy installations, the Naval Air Station, Key West, FL, and the Pacific Missile Test Range, San Nicolas Island, CA.

Results of the solar panel testing are sent to the Lewis Research Center, Cleveland, a NASA laboratory. NASA shares its findings with the U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA, which represents the Defense Department in the project.

A recent TECOM fact sheet describes this growing solar energy effort as "a national photovoltaic conversion program aimed at developing economically viable power systems capable of providing a significant amount of the nation's energy requirement by the year 2000."

MERADCOM Completes 2-Year Test of Engine Oils

Completion of a 2-year field test of two synthetic and two petroleum based engine oils was announced recently by the U.S. Army Mobility Equipment Research and Development Command's Energy and Water Resources Laboratory.

Although limited in scope, the test reportedly demonstrated that both products were capable of use under extended oil drain intervals, thus effecting a reduction in the supply of new oil and disposal of used lubricant. However, the test data indicated that synthetic oils are currently more expensive than mineral based oils.

Several other Army lubricant R&D programs are also in progress, including a 2-phase program pertaining to the use of synthetics in gasoline and diesel powered generator units. This program is being conducted by MERADCOM's Electrical Power Laboratory.

In the first phase of this effort, two different types of synthetic oils were used in the Army's standard 1½, 3, and 6 horsepower gasoline engines during 1,500 hours of performance tests. These engines were monitored for wear, fuel consumption, and general performance under various conditions.

The second phase will address the use of synthetics in various diesel engines. These engines will be checked and oils performance evaluated using similar criteria used with the gasoline powered units.

Two other programs, directed by the Energy and Water Resources Laboratory, are addressing the expanded use of arctic engine oils to solve specific seasonal lubrication problems encountered with tactical/combat vehicles.

The first of these programs, which is now in its second year, is being conducted at Fort Carson, CO, and involves year-round use of arctic lubricant in M60 tanks. The second program, at Fort Lewis, WA, will also employ M60 tanks and examine synthetic arctic engine oil under varying seasonal conditions.

These programs are expected to complement extensive efforts directed at development of multigraded engine oil for diesel powered tactical and combat fleets. In the multigraded program, synthetic and hybrid, synthetic-mineral oil blends are being studied to control lubricant volatility and flow characteristics.

When developed, this oil will hopefully provide a long needed year-round lubricant which can increase equipment readiness. These lubricants may also reduce maintenance costs and engine failures, and eliminate waste of good oil associated with temperature related oil changes.



Activation of a new Penetrator Materials Evaluation Facility—to provide direct support for the Army's kinetic energy weapon systems—has been announced by the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, MA.

Designed to provide a reliable correlation between reproducible ballistic performance and the metallurgical/mechanical properties of a fully characterized penetrator material, the facility is expected to reduce requirements for multiple and costly full scale testing.

Scale model penetrators with varying length to diameter ratios will be launched from a high velocity weapon system developed at AMMRC. Other features include multiple high-speed X-ray stations, and pressure/velocity instrumentation.

Initial test firings were conducted for Dr. Ernest Wilkins Jr., chairman of the new Army Science Board, during his recent visit to AMMRC.

A State-of-the-Art Computer for Firefinder

By Andrew R. D'Angelo

FIREFINDER Radar Systems are in production with issues to troops scheduled for FY 81. Two engineering models of the Mortar Locating Radar, AN/TPQ-36, (right) have been deployed in Germany to gain early inputs on operational and training aspects. The larger Artillery Locating Radar, AN/TPQ-37, has been in limited production since December 1976. The first production models will be delivered to the Army for field testing in January 1979.



The Army Firefinder Weapon Locating Radar Systems are the first fully automatic battlefield radars designed for use by ground combat units. These radars, the AN/TPQ-36 Mortar Locating Radar and the AN/TPQ-37 Artillery Locating Radar, rely on the speed and precision of a mini-computer to achieve the rapid and extremely accurate hostile weapons locating capability which are the key to their successful employment. The computer and its software are the "nerve center" of these radars and are the main features that distinguishes Firefinder from earlier weapon locating radar systems.

During operation of the radars, the computer controls all radar functions, and in fact guides the processing of all target returns, effectively eliminating "human interaction" during system operation. Most machine interface functions are computer controlled, as is all system hardware performance monitoring.

Additionally, the computer diagnostic programs perform automated system status testing and fault isolation, a critical function that on all previous radars required extensive crew effort. In an off-line mode, the computer provides control of an extensive built-in test equipment capability which provides automatic and methodical testing of virtually every aspect of the radar.

At the start of development of the Firefinder systems the AN/UYK-15 mini-computer was selected for use with these radars, since it was the most advanced machine available within the size and cost constraints of the system. This computer had many attractive features including a computer memory speed of 3/4 of a millionth of a second, the fastest militarized memory available at that time.

This computer performed well during extensive operational and engineering tests of the Firefinder radars; however, problems associated with its relatively old hardware configuration and size were causing concern to the developers. These problems were compounded by a growing list of computer functions which taxed the limits of the AN/UYK-15 memory.

Additionally, the startling advances in the state-of-the-art which occurred during the last five years held the promise of improving several major aspects of the computer. These advances, which included the development of microprocessors and high density militarized solid state memories, afforded the potential for substantial improvements in life cycle cost, reliability, maintainability, size, weight and capacity.

The dilemma facing the Firefinder project manager was how to take advantage of these developments while minimizing technical, cost and schedule risk. This was a significant challenge since the Firefinder radars had completed development, with one system (AN/TPQ-37) in low rate initial production and the other ready to enter full scale production. The major risk to the systems lay in assuring software compatibility, since software development has historically been a major obstacle on virtually all computer driven weapons systems.

Advantages offered by state-of-the-art computer technology could not offset the risk of losing software compatibility; therefore, any change would require a before the fact demonstration of software compatibility. Additionally, any computer change would have to have proven hardware, preferably of the same design as the rest of the radar to enhance maintainability.

In October 1976, Hughes Aircraft Co. had submitted a Value Engineering Change Proposal for an improved computer that would provide all the benefits of state-of-the-art technology. This computer which was an "emulation" of the existing computer was the result of an ongoing Hughes Aircraft Co. Internal Research and Development program. This change proposal was rejected since no hard test data was available to assure complete software compatibility.

Hughes continued to work on the emulator on their own and subsequently offered to demonstrate to the Army's satisfaction all aspects of computer-radar operations under terms that were acceptable to the Army. An extensive in-plant and live fire field test was conducted which verified the complete compatibility of their proposed Hughes emulator with the existing software. Based on the successful demonstration, Hughes resubmitted the Value Engineering Change Proposal in April of 1978, and after a comprehensive evaluation by a multi-disciplined team, the change proposal was accepted for inclusion in the Firefinder systems.

The resulting computer, which is now integral to the radars existing signal processor, is a fully militarized 16 bit computer using current microprocessor and memory technologies. Use of a Large Scale Integration solid state memory (vs magnetic core) has created significant space in the operations shelter for added communications equipment and storage, while affording a net weight savings of 120 lbs, eliminating a potential weight and balance problem.

The application of Large Scale Integration has also allowed a reduction in the total number of printed circuit cards from 72 to 26 while reducing the number of unique card types from 48 to 14. The previous computer had a memory size limitation of 64 thousand words while the new design allows simple plug in expansion to 128 thousand words with a growth potential to 512 thousand words when militarized 16 thousand (16K) Random Access Memory devices become available. With the currently available 4K devices each memory card contains 8K of memory, the 16K devices would allow 32K words per card providing 4 times the memory for the same size card.

In addition to the obvious logistics improvements resulting from the reduced card count described above, the introduction of this new computer allowed for incorporation of additional automated self test features which will greatly simplify maintenance and maintenance training. Integration of the computer into the existing signal processor eliminates the need for a separate computer maintenance manual and training program.

Improvement in computer reliability is also dramatic. Predicted reliability for the new computer with 64K of memory is 2612 hours vs 1887 hours for the previous computer with the same memory capacity. However, the older computer had significant unpredicted reliability deficiencies under severe environments, resulting from its method of construction and the configuration of its magnetic core memory. As an example, the previous memory had a low temperature operating limit of $-4°F$ while the new device can go to $-67°F$.

The combined technical improvements for the new computer bring with them very large dollar savings to the Army both in the short term and throughout the systems life cycle. Recurring units cost saving has been validated at $46.4 thousand per system.

Since this change was a result of a Value Engineering Change Proposal the government shares the saving with the contractor over the first three years, which still resulted in a net savings for the government of $3.0 million on the 128 radars produced in that period.

Since there is no sharing after three years, the government realizes a $6.7 million saving on the next 144 radars. Other savings accruing to the government resulting from reduced logistic support costs bring the total life cycle saving to $28.7 million.

The final result of this overall effort to put a state-of-the-art computer into the Firefinder systems is a lower cost, more reliable and maintainable radar system with the added flexibility to meet the future needs of the Army.

Restrictions on system capability resulting from limited memory capacity have been eased, giving the developer and user an opportunity to add desirable features at relatively low cost, assuring that the Firefinder radars can keep up with changing doctrine and threats.



ANDREW R. D'ANGELO has been the deputy project manager and chief engineer for the Firefinder Radar Systems since March 1973. He joined the U.S. Army Electronics Research and Development Command (formerly Electronics Command) in 1965 and has held several key positions in that Command, including deputy director of Product Assurance and chief of the Quality Engineering Division. Prior to that, he was employed as a senior staff engineer with the Federal Aviation Administration. His academic credentials include a BS degree from Long Island University and a MBA from Monmouth College. He has attended the Defense Systems Management College and is a Class of 1978 graduate of the Industrial College of the Armed Forces.

$166 Million Contract Orders AN/TPQ-36 Radars

Production, over a 3-year period, of 84 Army and 22 Marine Corps lightweight AN/TPQ-36 Firefinder radars is ordered in a $166 million contract announced by the U.S. Army Electronics Research and Development Command, Adelphi, MD.

The contract—which is with the Hughes Aircraft Co.'s Ground Systems Group at Fullerton, CA—also provides fourth and fifth year options for the production of 82 additional radars.

Three AN/TPQ-36 mortar-locating radars and two of the larger, more powerful AN/TPQ-37 artillery-locating radars, when deployed within an Army division, make up one complete artillery Firefinder system. The smaller radars are used to locate close-in mortars and artillery, while the larger ones are used to find long-range artillery and have been in limited production since 1976. Both use a common operations shelter.

Expected to be employed a few kilometers behind the front lines, the AN/TPQ-36 scans the horizon with a pencil-shaped beam so quickly that an electronic "curtain" is formed over the sector covered. The radars then automatically spot, track, and plot the trajectory of projectiles rising through the curtain. This information is automatically relayed to friendly firing units so they can direct counter-fire against hostile firing points.

The AN/TPQ-36 was developed under the Army's design-to-unit production cost concept, aimed at eliminating "frills" and providing affordable hardware. Full-scale production of the quickly deployable radar, approved in December 1977, followed five years of development and testing.



Gama Goat transports TPQ-36 in mobile configuration

UPDATE

The schedule for the Army's conversion from three brake fluids to one (see *Army RDA Magazine,* Jan-Feb 78) has been revised in light of a validated cost study developed jointly between the U.S. Army Mobility Equipment R&D Command and the U. S. Army Tank-Automotive Material Readiness Command in October 1978.

The single hydraulic brake fluid will not be introduced in 1978. The schedule of conversion will be determined in the pending development of an implementation plan by TARCOM, which is based on an agreement between MERADCOM and TARCOM to recommend implementation of the changeover to the silicone brake fluid.

The estimated yearly savings of $2 million has been refigured as $1.3 million as the result of a validated economic analysis.

Measuring Camouflage by Numbers: Will DEFT Research Make it Possible?

By Joseph F. Hannigan

Camouflage is generally recognized as one very necessary factor for enhancing battlefield survivability. Good camouflage reduces the susceptibility to hostile surveillance. At the U.S. Army Engineer Topographic Laboratories (ETL), we are exploring the feasibility of using Direct Electronic Fourier Transform (DEFT) technology to answer certain important questions which naturally arise concerning camouflage.

How does one measure camouflage? How much has the susceptibility to hostile surveillance been reduced by camouflage? What is the actual improvement that can be expected from foliage, patterns, nets, or other shape-disruptive camouflage measures? How can the degree of obscuration by smoke, for example, be determined? These are important questions to the tactical commander, the camouflage research specialist, and anyone interested in the "bottom line" of camouflage effectiveness.

Preliminary results of our research indicate that DEFT technology can be used to provide scientific answers to such questions—answers in numerical form for consistent, repeatable results. In fact, I believe the DEFT device can become the first yardstick for camouflage measurement.

The theoretical basis and initial experimental results on the use of DEFT technology for making quantitative measurements of camouflage were reported to the 1978 Army Science Conference in a paper entitled, "Direct Electronic Fourier Transforms (DEFT) for Camouflage Signature Measurement (CSM)."

Its potential value to the Army was recognized with a Scientific Achievement Award. The Camouflage and Topographic Laboratory, MERADCOM, Fort Belvoir, VA, has reviewed this paper favorably. Current plans are for a working group of representatives from both laboratories to expand this work.

I am experimenting with a numerical scale based on the hiding factor, which can be computed from the DEFT-ographic image of an object. Zero on the scale indicates an image completely disclosed to the naked eye. A DEFT reading of 100 means the image is 100 percent hidden, or completely unrecognizable.

Development of this method for quantitative measurement of camouflage is believed to be the first successful attempt at objective and scientific measurement of this very subjective entity. Its primary application would seem to be as a sophisticated tool for the camouflage specialist. In the hands of a skilled camouflage specialist, it could significantly reduce the time and cost of developing and testing shape-disruptive camouflage.

Current testing of camouflage required the logistic effort and expense of placing scores of trained observers and full-scale military equipment into the field for each new design or pattern. Testing also requires a significant number of personnel to apply the camouflage to the military equipment. Using DEFT technology and scale models, the camouflage specialist could design and test a multitude of camouflage types and variations under any desired condition in the laboratory, prior to final testing under field conditions.

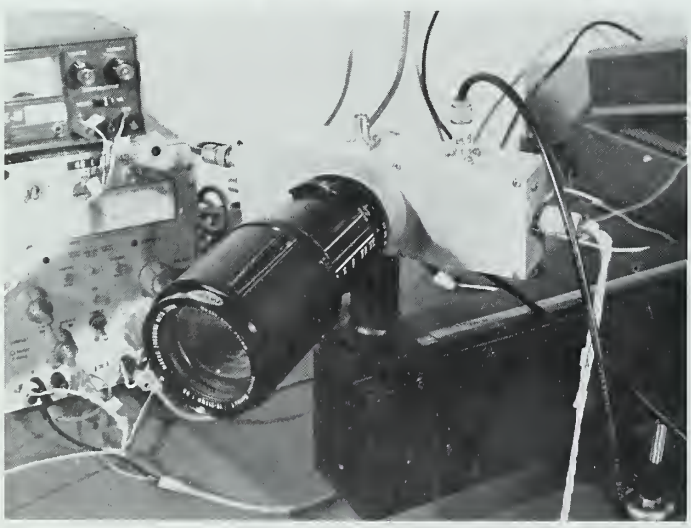


Fig. 1. Direct Electronic Fourier Transform

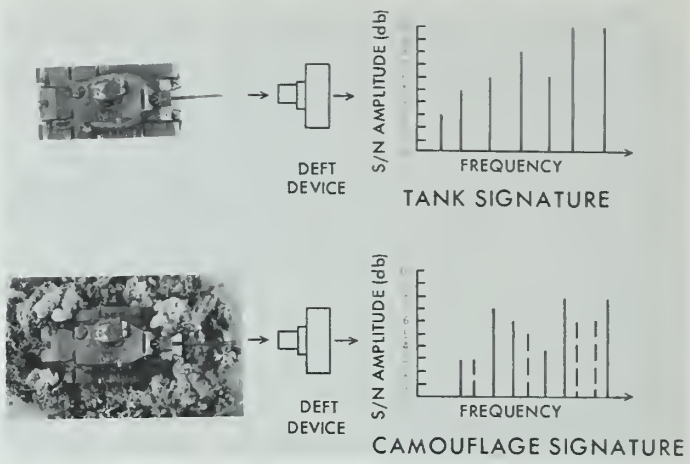


Fig. 2. DEFT Spectrum Signature of a Tank With and Without Camouflage

It is also possible that DEFT technology could provide data to assist in the design of camouflage. This would be analogous to the use of computer aided design (CAD) for electronic circuits by electronic engineers. DEFT data could conceivably yield new comparative analyses of what makes good camouflage, i.e., how much each specific type of camouflage actually reduces the susceptibility to hostile surveillance.

Though sophisticated in design, DEFT devices are rugged, light, and simple to operate. These features plus solid-state construction and low-power requirements suggest the possibility of developing portable, field serviceable DEFT cameras that tactical troops could use to evaluate their own camouflage efforts as well as to detect concealed enemy ordnance.

For camouflage evaluation, the DEFT device might incorporate a pocket computer programmed to read out either the percentage of concealment or the concealment range, i.e., the distance beyond which the military object is not susceptible to hostile surveillance.

The results of initial experiments on a small scale, using photographs and a simple questionnaire, show high correlation between DEFT scale readings and human estimates of the degree of camouflage. The difference between the objective DEFT measurements and the mean of a set of subjective human judgments was 0.5 percent for one camouflage situation and 1.5 percent for another camouflage situation.

DEFT devices are a new breed of "smart" sensors about the size of a 35mm camera. A DEFT device is shown in Figure 1. They are "smart" because they physically perform one type of image analysis, i.e., the Fourier transform. Other technologies, i.e., computers and coherent optics, require large, delicate equipment for similar types of analysis.

DEFT technology uses surface acoustic waves (SAW) and electro-optics (E-O) to physically analyze the shape of an object by converting that shape into a series of sinusoidal radio frequency waves. These waves are obtained by the interaction of the SAW with the light distribution pattern of the object which is focused on an E-O Detector. The series of radio frequency waves thus obtained constitutes the signature of the object. Such a series of waves is referred to as the Fourier frequency spectrum of the object.

In principle, if these waves are properly combined, an image of the object can be reconstructed. It should be noted that this fre-

quency spectrum is not the same as that used to create a TV image. This Fourier frequency spectrum of an object can be thought of as something akin to atomic emission spectra which are used to identify the presence of various atoms in a substance. Fourier spectra identify objects by their shapes.

The use of the Fourier frequency spectrum in this manner is but another application of an important body of mathematical analysis. It is based on Fourier's Theorem, which in simplified terms states that any function, no matter how complex (in our case, a camouflaged military object) can always be resolved into a series of sinusoidal frequencies.

Fourier's Theorem also states that the magnitude of each frequency is an indication of its importance to the original function (in our case, the original military object). Thus, we are led to the conclusion that, if we can measure the Fourier spectrum of a military object, e.g., a tank, without camouflage, then measure the Fourier spectrum of the same object with the addition of camouflage we will obtain two spectra which can be compared frequency-by-frequency to determine the change which is attributable to the change in the object shape due to camouflage.

The concept is illustrated in Figure 2. The Fourier frequency spectrum as obtained from a DEFT device is shown for a tank without camouflage and the same tank with some degree of camouflage from foliage. In this idealized situation, seven frequency components, each having a specific amplitude, identify a tank without camouflage. This spectrum represents zero camouflage.

When camouflage in the form of foliage is added, the spectrum is changed. The frequencies depicted by broken lines represent new Fourier frequencies that are added to the signature because of the foliage. Closer examination of the second spectrum reveals a reduction in amplitude of most of the frequencies. Still closer examination reveals that one original frequency is completely eliminated (i.e., the first) and another is increased (i.e., the third).

These changes are all in accordance with Fourier theory. The sum of all of these frequency changes is a scientific measurement of the actual physical change in the shape of the object due to the addition of camouflage. Note that the amplitude of each frequency is expressed in terms of signal to noise ratio (S/N) in decibels (db). This is standard for communications work.

The ratio of the sum of the changes in amplitude of the frequency spectrum to the sum of the amplitudes of the original signature of the object is defined as the "hiding factor" due to camouflage. It is expressed mathematically as:

$$\text{H-Factor} = \frac{\Sigma|\Delta(S/N)|}{\Sigma\ (S/N)}$$

Professors S. T. Kowel and P. G. Kornreich of Syracuse University invented the DEFT device in 1974. The Advanced Concepts Team, DCSRDA, HQDA, first recognized the potential of DEFT technology for Army applications. This team of scientists and technical experts recommended military development of DEFT to the Deputy Chief of Staff for Research, Development, and Acquisition.

In 1976 DCSRDA designated the Night Vision Laboratories, Fort Belvoir, VA, as the cognizant agency for technology and device development. ETL's Research Institute was chosen to provide technical support because of the Topographic Laboratories' extensive background in image analysis.

The Research Institute's program to investigate the potential of DEFT technology for topographic applications and to expedite technology transfer pursued a multitude of potential applications. Less than one man-year of work under the In-House Laboratory Independent Research program showed camouflage to be one of the less complex of several applications that are ripe for development.

The measurement of camouflage is but an intermediate by-product of this program to exploit DEFT technology for the Army, one application which DEFT's inventors did not anticipate. It is directly related to one of the program's long-range objectives, namely, "change detection." Change detection is very important for keeping maps and tactical overlays up to date.

Another application to be explored is automatic feature extraction, i.e., finding specific topographic features in aerial photographs. Camouflage and feature extraction can be considered to be inverse processes. Other objects of ETL's research into possible uses for DEFT include image analysis, map information processing, optical alignment, map matching, target and scene identification, missile guidance, land navigation, point positioning, and velocity measurement.

In conclusion, DEFT technology opens the door toward making camouflage a military science as well as a military art. DEFT's latent value for the evolution of camouflage techniques is best expressed in the words of Lord Kelvin: "When you can measure what you are talking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."



JOSEPH F. HANNIGAN has been a physicist at the Research Institute, U.S. Army Engineer Topographic Laboratories since 1961. From 1953-61, he was a physicist at the Camouflage Branch, USAERDL (now MERADCOM). From 1950-52, he was an armored infantry platoon leader and company commander in the 2d Armored Division.

Hannigan received his bachelor's degree from Oklahoma State University in 1950 and his master's degree from Catholic University in 1971. He holds two patents and has authored over 20 articles and reports. A winner of a 1978 Army Science Conference Scientific Achievement Medal, he also received the Army R&D Achievement Award in 1973. He is a senior member of the IEEE and belongs to several other professional organizations.

Software Meet Focuses on Tactical Computers

The DARCOM Tactical Computer Software Conference, oriented toward the project manager and system developer of tactical computer-based systems, attracted more than 240 participants, including 10 general officers from throughout DARCOM. The U.S. Army Communications Research and Development Command was host to the 3-day conference at Fort Monmouth, NJ.

MG Hillman Dickinson, CORADCOM commander, was the overall chairman of the conference which considered problems that are encountered during the system life cycle.

The conference covered software topics relating to software acquisition and the system life cycle; acquisition issues, development issues, testing and evaluation, interoperability, military computer family program and post-deployment and support.

MG Robert J. Lunn, director of Development and Engineering, DARCOM headquarters, presented a DARCOM management perspective of the software acquisition situation.

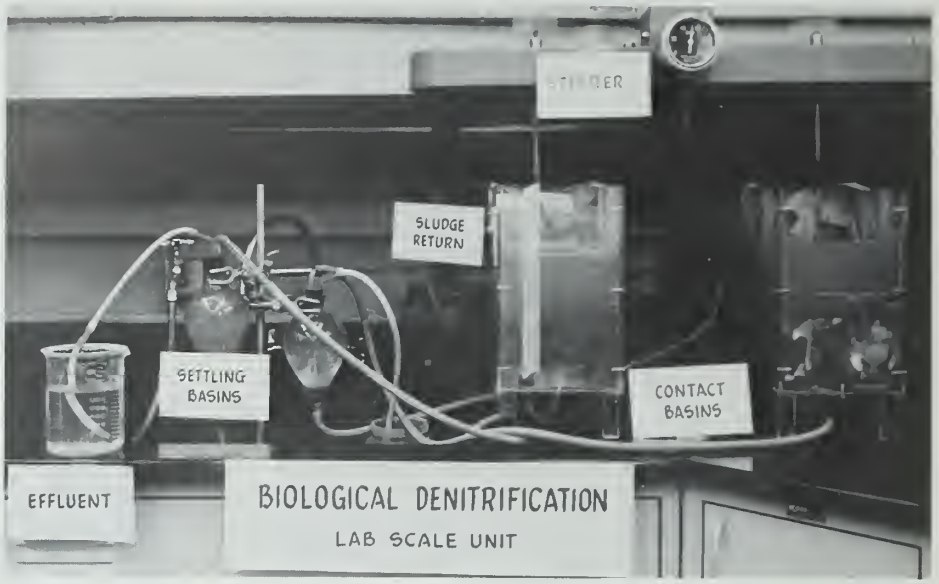
BG Donald R. Lasher, program manager, Army Tactical Data Systems (ARTADS), and deputy commanding general, CORADCOM, presented the project manager overview during the initial session. COL F. D. Campbell of the Combined Arms Combat Development Activity, discussed the tactical user perspective, showing the new directions which have been established for Army battlefield integration.

In the concluding sessions GEN John R. Guthrie, DARCOM commander, received summary reports, issues and recommendations from six general officers who were cochairmen of technical sessions. These summaries are intended to provide future direction in key areas of software acquisition and management.

Active participation by DARCOM commands and project managers reportedly contributed to the success of the conference. Twenty-seven technical papers were presented in eight comprehensive sessions which addressed the key software issues. The keynote banquet speaker, Martin B. Zimmerman, deputy assistant chief of staff for automation and communications, provided insight into his new Department of the Army office.

Technology for Wastewaters Pollution Abatement

By David E. Renard



The U.S. Army Armament R&D Command's Chemical Systems Laboratory (CSL), DARCOM lead lab for Pollution Abatement and Environmental Control Technology, will soon begin evaluating a number of R&D projects for the treatment of munition plant wastewaters to determine the Best Available Technology Economically Achieveable (BATEA).

The evaluation program is still another step in carrying out provisions of the Clean Water Act, amended in 1977, which includes a technology deadline established for 1984.

The Environmental Protection Agency (EPA) has also started a program to recommend BATEA for the explosives industry and is looking to the Army as the major producer to describe the scope of the problem and technological development leading to their solutions.

In the past, government owned—contractor operated munitions plants have discharged much of their wastes directly into local rivers and lakes. This practice has had adverse effects on the ecology of the area and citizen complaints have been numerous. Violations of the National Pollutant Discharge Elimination System are often reported, even now, during a time when production of explosives is at a low, peacetime level.

A major DARCOM effort, supported by several programs and fully coordinated by the Project Manager, Munitions Production Base Modernization and Expansion, is geared toward munition plant modernization. Pollution abatement technology for DARCOM's 28 Army Ammunition Plants is a significant portion of both the modernization and the new plant design and engineering.

To coordinate the pollution abatement efforts of seven R&D laboratories, DARCOM created a lead laboratory for Pollution Abatement and Environmental Control Technology (PAECT). This lead laboratory mission was assumed by CSL following the Army Armament reorganization of 1977.

Located in the Edgewood Area of Aberdeen Proving Ground, MD, the lead lab coordinates environmental quality research tasks at the U.S. Army Armament R&D Command, the U.S. Army Natick R&D Command, the U.S. Army Mobility Equipment R&D Command, the Electronics R&D Command, and the U.S. Army Test and Evaluation Command.

Guidance for program management is provided by a technical advisory board comprised of R&D investigators, managers, users, and consultants. The program is integrated with environmental quality R&D efforts in the Office of the Surgeon General and Office of the Chief of Engineers.

The highest priority thrust in the PAECT program is the treatment of wastewater from munition production and explosive wastes. Investigations include development of chemical and physical treatment disposal methods for munitions plants and facilities, recovery and reuse methods for excess and obsolete explosives, and automated techniques for field separation and analysis of chemical pollutants. Each of these areas is a candidate for the determination of BATEA which, when implemented, will assure that Army munition plants are in compliance with the laws and in harmony with the environment. The lead lab also addresses research associated with new materiel development and the treatment of industrial wastes resulting from the Army's mission.

The Chemical Systems Laboratory is currently developing a team of experts to prescribe BATEA from the Army point of view so that recommendations can be used in coordination with the EPA, which seeks to publish BATEA criteria for the explosives industry by the end of 1979.

The team will go further than the immediate EPA requirements. They will evaluate current R&D efforts for munition waste treatment, resource recovery, and monitoring techniques and recommend which directions of research will be pursued. The plan is to bring several years of research and development to a logical and fruitful conclusion while supporting the implementation of the recommended technology.

Best available technology, once recommended, will not remain static. Improvements in wastewater management will need to be responsive to changing legal requirements, technological advances, and mobilization conditions at munitions plants. Processes not economically feasible for use by 1984 could emerge as BATEA by 1990 and might constitute a second generation of treatment technology.

Four distinct types of munition wastewaters are recognized although current treatment methods generally address only one or two of these at a time. "Red" water is the filtrate from the purification of TNT and contains high concentrations of soluble sulfonates of TNT isomers along with inorganic salts and small quantities of TNT itself.

"Pink" water results from the wash down of equipment used to melt, blend, pour, and assemble TNT and other explosives into munitions and is dilute but toxic to fish and animals. The color results from the action of sunlight on the TNT as a complex array of degradation products are formed.

Propellants such as nitroglycerin, nitrocellulose and nitroguanidine form another pollutant type. Once denitrified, the compounds become amenable to biological degradation which yields acceptable discharges with no adverse ecological impact.

The explosives RDX and HMX are chemically related to each other but are unlike compounds in other categories of explosives. Treatment of wastewaters containing these cyclic nitramines might have to be different from treatment for other explosive wastes.

"Red" water is presently concentrated and incinerated, a process that is expensive and energy intensive. Alternatives to be assessed by the team include process modifications which reduce the quantity and recover and reuse components from the "red" water.

The Sunoco Process involves heating

the "red" water with carbon and aluminum hydroxide, forming sodium aluminate. This is then treated with sulfur dioxide, reforming sodium sulfite and aluminum hydroxide which are separated and reused in the TNT purification process.

A new magnesium sulfite process gives higher TNT yields, greater purity and requires less carbon and energy but has less solubility and introduces more process change over. A nitric acid recrystallization process for purifying TNT eliminates red water altogether but the residue, isotrioil, is being studied for separation of components and recycling into the process. As a major process change, this would involve significant redesign and capital costs.

Another approach is to re-examine weapons systems to determine whether unpurified TNT can be employed which would also eliminate "red" water from the purification process. Chemical and physical treatments of "red" water are also possible and will be considered in the total assessment of "red" water elimination or treatment.

The cost of completing and installing each process will be estimated and the potential for meeting effluent guidelines will be established at the four ammunition plants currently producing TNT.

"Pink" water results from operations at 14 ammunition plants, some of which only collect the waste in leaching ponds or lagoons while others have installed activated carbon filtration systems. Carbon columns are effective at removing explosives from the wastewater, but the process becomes expensive because saturated carbon must be incinerated, which contributes to air pollution. There is also no opportunity to recover any of the collected TNT.

R&D studies are examining both thermal and solvent regeneration systems to extend the economic life of the activated carbon and reduce the logistic burden. Granular carbon is most frequently used, but less expensive powdered carbon may soon have application and can be regenerated by a patented Atomized Suspension Technique.

Acetone, methanol, and toluene have been investigated as chemical solvents for carbon regeneration. Efficiency can be increased by pre-treatment of the granular carbon with hot hydrogen gas.

Several alternatives to carbon adsorption have also been studied. Polymeric resin adsorption, ultraviolet irradiation with ozonolysis and reverse osmosis are processes capable of removing or destroying explosives and their byproducts in "pink" water. However, economic drawbacks are likely to eliminate these techniques from the recommendations of the BATEA study team.

A chemical treatment method likely to find application uses diamine surfactants to complex with and precipitate TNT and RDX products from the wastewater. The same material is being evaluated as a method to "fix" the explosive residues in lagoons and settling ponds to half migration of the toxic compounds into groundwater.

Microfiltration through porous tubules has also been effective at concentrating "pink" water. This method may find application in combination with other systems to give the optimal treatment system. Biological treatment methods have been ruled out for "pink" water because the resulting products are more toxic than the original TNT residues.

Wastewaters from nitroglycerin manufacture are generally collected in evaporating ponds and then discharged to waterways. Several treatment processes have been proposed; reverse osmosis, activated carbon adsorption, polymeric resin adsorption, ozonation, and sulfide decomposition. Each has drawbacks which make it unsuitable for effective treatment. Lime and caustic adequately hydrolyze nitroglycerin but the use of this degradation process is dependent on the identification of the kind and amount of the products.

Biological treatment is a viable option for nitroglycerin and other propellant wastes. Microorganisms are capable of biotransforming the dilute explosives in aerobic or anaerobic systems. Several biological treatment methods are under study to assure that the transformations are complete and result only in harmless byproducts.

A fluidized bed biodenitrification system has high potential utility as an anaerobic method, and a rotating bio disc is an effective aerobic technique for these nitrate ester explosive wastes. Biological treatment processes are generally economical and logistically simple to operate, but need to be carefully examined to assure that only environmentally acceptable products result.

Several specialized nitrate esters, manufactured for use in propellant formulations, are also being considered for treatment for their wastewaters in the same biological treatment systems as nitroglycerin. The biodegradability of individual materials and the interactions of complex mixtures are being studied at present.

The manufacture of nitrocellulose results in wastewaters that are highly acidic and which require neutralization. The nitrocellulose is virtually insoluble so the problem is not toxicity, but the accumulation of fine particles of the explosive.

Solids removal processes including centrifugation, dissolved air flotation, coagulation/flocculation, granular filtration, and resonating filters, have not been fully effective at reasonable costs.

Treating nitrocellulose wastewaters with excess lime for neutralization creates a sludge containing the fines. The sludge can be dewatered and landfilled but the fate of the nitrocellulose in the alkaline medium appears to be degradation to a variety of products which can adversely affect leachate quality and subsequent biodegradation.

Treatment of wastewaters containing RDX and HMX is a dual problem, one being the residues from loading, assembly and packing operations, and the other from the actual manufacturing process. At some munition loading operations where RDX is blended with other explosives and propellants, activated carbon treatment or evaporation ponds have been employed.

Carbon filtration is effective but the subsequent incineration is costly, wasteful, and air polluting. The processes being evaluated for "pink" water treatment are also determining the fate of RDX in the system along with the TNT residues.

Since they can occur together, a single treatment technique is desirable, so polymeric resin adsorption, ultraviolet irradiation with ozonolysis, reverse osmosis, the surfactant separation have been studied as well as activated carbon and its regeneration.

To treat the manufacturing wastes, a biological treatment facility would be desirable, but the present evidence that RDX and HMX can be biologically degraded is inconclusive. A research study is addressing this issue to determine whether biological processes are valid.

The team of scientists and engineers evaluating the various treatment technologies will have a complex task assessing the feasibility of each method, its economics, and its potential utility.

Preliminary recommendations are planned for completion prior to the EPA deadline for publication of the BATEA for the explosives industry. More detailed recommendations and plans will follow and will be aimed at bringing Army ammunition plants into compliance with environmental laws.



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17th Army Operations Symposium Focuses on 'Readiness'

Operations research and systems analysis (ORSA) applications in support of U.S. Army present and future requirements were considered by about 300 military and civilian representatives from the U.S. and abroad at the 17th Annual U.S. Army Operations Research Symposium, 7-9 November, at Fort Lee, VA.

Sponsored by the U.S. Army Materiel Development and Readiness Command, the meeting was cohosted for the fifth consecutive year by the U.S. Army Quartermaster Center and Fort Lee, commanded by MG Fred C. Sheffey, the U.S. Army Logistics Center, commanded by MG Homer D. Smith, and the U.S. Army Logistics Management Center, commanded by COL James E. Harris.

The objective of the Army Operations Research Symposium is to provide a stimulating forum for the Army's ORSA community relative to the needs of both the user and the analyst. Featured on this year's agenda were general session presentations, panel discussions, and special sessions devoted to solicited and contributed papers.

Arrangements were made by the U.S. Army Materiel Systems Analysis Activity, Aberdeen (MD) Proving Ground. This year's theme was "Readiness—The Key to a Credible Combat Capability."

Symposium chairman Mr. Keith A. Myers, who is chief of the Combat Support Division at the Army Materiel Systems Analysis Activity, called the meeting to order and introduced Army Logistics Center Commander MG Smith for welcoming remarks.



GEN John R. Guthrie

GEN John R. Guthrie, commander of the U.S. Army Materiel Development and Readiness Command opened the formal presentations with a discussion of the role of operations research and systems analysis in relation to the Army's readiness posture. He noted that ORSA must play an expanding role in the Army, and that political and economic factors are impacting on Army programs to a greater degree than ever before.

Guthrie repeated his statement (which was carried in the foreward of the symposium program) that it is imperative that the analytical community provide the best available information, quantified insofar as possible, to decision makers at all levels. Operations research and systems analysis can and must play a major role, he said.

He added that decision makers must make hard choices and must rely on more than just intuition or gut feelings. They must know where they want to go when they make a decision. Relative to existing resources, he stressed that "we must do more with what we have."

Operations research, he said, can now be applied to quantitative analysis of more areas than was previously possible. For example, said Guthrie, operations research can now help determine what things need to be product improved and to what degree.

Guthrie stated that he is not convinced that losing the first battle means that the whole war will necessarily be lost. Winning the last battle of the war, he noted, may sometimes be even more important than winning the first battle.

The General explained that operations research and systems analysis can be most useful in fielding a "complete system." Neglecting one aspect of a system can impact negatively on the Army's readiness, he added. He cautioned, however, that ORSA, like all things does have its limitations and this is important to remember.

Dr. Joseph Sperrazza, director of the U.S. Army Materiel Systems Analysis Activity, introduced this year's keynote speaker—Under Secretary of the Army Dr. Walter B. LaBerge, who spoke on Simulation and Operations Research.

The Army Under Secretary began his remarks with a discussion of Civil War battles in the Richmond and Petersburg, VA, area. He stressed that it would have been extremely difficult for ORSA experts to predict the outcome of many of these Civil War campaigns.



U.S. ARMY QUARTERMASTER CENTER AND FORT LEE COMMANDER MG Fred C. Sheffey (center), flanked by Army Logistics Center Commander MG Homer D. Smith (left), and Army Logistics Management Center Deputy Commandant COL Edouard A. Peloquin.



Dr. Walter B. LaBerge

The Petersburg battle, he said, pointed out that it is important to demonstrate to an enemy that we are capable of winning a war. "We have an obligation," he continued, "to show an enemy that they cannot defeat us."

LaBerge noted that he had seen a fair amount of output of the Army's operations research community since taking over his present duties more than a year ago. He followed with a discussion of some of his impressions to date.

He emphasized that the Army's ORSA is honest, competent and improving. He added, however, that "we sometimes worry too much about Army positions and don't know yet how to speak to the Green Suit Army." LaBerge stated that ORSA must be put in terms that people can understand so they will listen.

We are good, he explained, on individual items, but not so good on entire systems applications of operations research and systems analysis. We are not good, he added, on the "whole war" and we tend to underestimate the difficulty of problems of large systems.

The Army Under Secretary also noted that the Army's ORSA community is good at models and methods, but sometimes the model drives the analysis. Said he: "We often forget the vitalness of data and tests, we need to test our data."

He also maintained that too much emphasis, relative to ORSA, is placed on the

active Army. Not enough consideration is given to the "total Army," he said. He added that greater attention should also be given to the civilian community and the Reserve components so that the enemy will be convinced that every element of society is prepared to get involved.

LaBerge noted that the Army ORSA community should also consider things as they might exist in 5 or 10 years. "Too much emphasis," he said, "is placed on our current Army, we must improve our recruiting and consider the available manpower of tomorrow."

Under Secretary LaBerge stressed also that the Army must learn to look at the "whole picture" and consider worldwide requirements when formulating solutions to problems.

The ORSA community, he argued, still doesn't have adequate models in certain areas, and tactics should be more realistically simulated. Inputs of our analyses must be reasonably realistic as to what might really occur in a real war, he added.

The Under Secretary also stressed that the chemical and nuclear areas of analysis need improvement. He stated that the current approach was inadequate.

He also called for greater participation with our allies. Our analysts, he said, must also consider those with whom we fight. The Army, he added, should establish closer ties with our own and other Armed Forces and other U.S. civilian agencies.

LaBerge closed his remarks by stating that too often "we get swept up with our own Gold Watches." Our analyses, said he, are only as good as the data that go into them. He appealed to the audience to do not only the things they are asked to do, but also the things they know they must do.

MG Maxwell R. Thurman, director of Program Analysis and Evaluation in the Office of the Army Chief of Staff, followed Under Secretary LaBerge with a report on some of the new concepts and tools which are being used in support of Army programing.

Zero base budgeting, one of the new concepts he discussed, has probably had one of the most far reaching effects, he said. ZBB, he noted, is significant because it forces a view of the Army as a totality, focusing attention on the Army's mission and discrete functional packaging.



MG Maxwell R. Thurman

His presentation also dealt with Zero Base Programing, Affordability, the Program Development Increment Package, Functional Programing, and Force Packaging Methodology. Some major changes in budgeting and programing are and will continue to impact on the Army's future readiness and these new concepts are part of those changes, he said.

Force Packaging Methodology, noted Thurman, allows us to look toward the future with more reliability and it provides a ready tool. One of the essential parts of Force Packaging, said the General, is the balancing of effort within a given package.

Thurman maintained that the Army must consider operations and support costs more than it has in the past. One of our biggest concerns, he said, is manpower and personnel because they are a scarce resource.

The General then posed the following question: How do you set priorities relative to which programs should be funded and how much to fund each program? He responded by stating that the prioritization process must include: uniform rationale for identifying program packages; judgment values based on mission goals; functional (multi-appropriation) prioritization; alternative strategies for various funding levels; and documentation of the process.

Thurman closed his address by restating that the Army is very good at developing investment costs, but is lackluster in developing operational and support costs. He called on his audience to provide suggestions for improving the programing and budgeting process.

A tutorial on Methodology for Life Testing was the title of a "cram course" presentation by Dr. Nozer D. Singpurwalla of the Department of Statistics, Stanford University and George Washington University. Presented on a progressive basis on each of the three days of the symposium, his tutorial dealt with some of the basic concepts of life testing.

Singpurwalla indicated that the purpose of life testing was to determine a systems mean time to failure, the failure rate, or the entire failure rate distribution. Some of the different types of life tests he discussed were censored, truncated, and sequential.

Dr. Richard J. Trainor, director of Systems Review and Analysis, Office of the Army Deputy Chief of Staff for Research, Development, and Acquisition reported on Major System Resource Demands and their implications. Major systems, relative to R&D, are usually those systems costing more than $75 million, he said.



Dr. Richard J. Trainor

Once a system enters full scale development, said Trainor, it begins to consume large amounts of dollars. Among the systems he briefly discussed were the XM1, MICV, Bushmaster, Hellfire, and the DIVAD Gun. These systems, in general, seem to be progressing pretty well technically, he said.

Trainor noted that it is much easier for a U.S. President to decide not to begin a new program than it is to cancel an existing one. He added that most high cost systems are geared toward high or mid-intensity conflicts abroad.

Although the Army's programing has its shortcomings, it still does well in comparison to the other Armed Services, he stated. He indicated also that it was unfortunate that the programs that usually get cut are very seldom the ones responsible for throwing off the programing and budgeting plan.

He explained that the analysis community could be of particular help in developing better planning and better programing. Analysts, he said, must get involved early in the process and they should deal with much broader subject matter.

Specific approaches to programing and budgeting, which he discussed, included Force Structure Analysis, Programing Related Analysis, and Support Impact Analysis. Trainor emphasized that resource demands are large and are growing, but that the funding outlook is only fair.

MAJ Richard D. James of the U.S. Army Combined Arms Combat Developments Activity, Fort Leavenworth, KS, followed with a presentation on Techniques for Controlling Proliferation of Automation on the Battlefield. He discussed the philosophical and historical aspects of this management program.

Management of battlefield automation, he stated, is a complex task for the Army. Past efforts, he noted, have been largely independent and the results have led to only incidental standardization.

Mr. John W. Kramar, U.S. Army Materiel Systems Analysis Activity, spoke on Red JMEM Small Computer Methods and Other Updates to the JMEM Manuals. His

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address covered an inter-service group effort to improve the data base and analytical methodology used in determining the effectiveness of non-nuclear munitions.

New Model Design and Operational Test Planning based on the TRASANA Information and Data Base was the title of a highly sophisticated and detailed address by Mr. Roger F. Willis of the U.S. Army Training and Doctrine Command Systems Analysis Activity.

Backed by more than 25 years of experience in the ORSA field, Willis described an operational manual data base which has been in existence at TRASANA since January 1978. Much of this information and data, he said, was extracted from operational test reports with each item identified in terms of source.

Banquet speaker Mr. Ingo Swann, a consultant with SRI International, Menlo Park, CA, provided a "thought provoking" approach to analysis with his address on The Threat of Possible Psychic Techniques In Future Conflicts. He described a future oriented synthesis based on a 100 years of psychic research and mistakes.

He spoke from the hypothesis and conviction, he said, that psychic abilities exist and that any technology which can develop sufficient control of them will use



Ingo Swann

them in diverse ways. He added that among lay people, scientists, and even parapsychologists themselves, extra-sensory perception has been subjected to many misconceptions.

Relative to the Soviet Union, he noted that their primary research efforts in this field are directed at discovery of practical applications for parapsychology. Their research in this area during the past 40 years, said Swann, indicates an interdisciplinary approach.

Closing General Session Speakers. Mr. Walton Sheley, deputy director, Procurement and Systems Acquisition Division, U.S. General Accounting Office, presented an address on GAO's Views on Department of Defense Studies and Tests.

Although the scope and timing of tests and analyses are influenced largely by their sponsors, by current tactics, and by doctrine, he said, the GAO believes much can still be done to improve the evaluation of new or improved weapon systems.

One of these improvements, said Sheley, would be to establish closer ties between actual tests and studies. Long-range planning such as that described in Cost Operational Effectiveness Analysis documents should not be a purely intellectual activity, he noted.

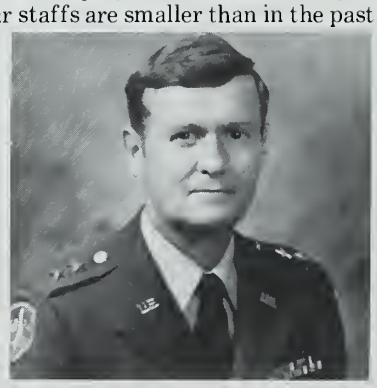
A second suggestion, cited by Sheley, would be creation of more operationally realistic tests. Test results, he said, should not be termed realistically representative unless they are. He stressed that controlled introduction of degrading battlefield influence, through actual or simulated means, is necessary if weapon systems evaluations are to be credible.

Finally, Sheley called for closer ties between the analytical and test communities. He encouraged the current trend toward more joint tests by the various U.S. Armed Services in order to provide timely data for procurement decisions.

The GAO, he said, has long advocated joint service testing and evaluation to determine the best mix of new weapons and supporting systems in mission areas cutting across the Services.

MG Robert L. Bergquist, DARCOM deputy commander for Resource Management, presented a discussion of the DARCOM Manpower Baseline Study. He reviewed the impact that declining resources are having on both the readiness side and the RDT&E or development side of the house.

Bergquist noted that readiness and development were being impacted upon negatively because of manpower cuts and increased workloads. For example, there are more project managers today, but their staffs are smaller than in the past.



MG Robert L. Bergquist

He indicated that although more work is being contracted out of house, there is a limit to what can and should be done outside. The General stated that DARCOM has gained support for $50 million to help provide stability in FY 1979. He added that other solutions to the resource problem may be more consolidations and realignments, and closer ties with Reserve components.

Deputy Under Secretary of the Army for Operations Research Mr. David C. Hardison was the concluding general session speaker. He candidly critiqued the symposium and expressed some thoughts for the future.

One of his criticisms of this year's symposium was that some of the papers in the special sessions did not adequately address the symposium theme of readiness. He also stated that too much emphasis was placed on systems analysis and too little attention was given to the "man-



David C. Hardison

machine" interface. He added, however, that he was impressed by the symposium's sensitivity to issues such as RAM-D. In general, he praised the overall quality of this year's presentations.

Special Sessions. In addition to general session speakers, this year's symposium included nine concurrent special sessions devoted to solicited and contributed papers and panel discussions. Titles and chairman of the special sessions were: *Logistics and Readiness Analyses*, Mr. Elwood Hurford, Army Logistics Center; *Weapons Effectiveness Analyses*, Mr. John Kramar, Army Materiel Systems Analysis Activity; *Combat Analyses*, Mr. James H. Peters, TRADOC Systems Analysis Activity; *Resource Analyses*, Dr. Richard Trainor, DCSRDA; and

Intelligence, Communications, Command and Control, Mr. John Clark, Army Concepts Analysis Agency; *Testing and Field Exercises*, Mr. Walter Hollis, Army Operational Test and Evaluation Agency; *New ORSA Techniques and Testing Methodology*, Dr. Jagdish Chandra, Army Research Office; *Selected Topics of General Interest*, Dr. Marion Bryson, Army Combat Developments Experimentation Command; and *Classified Session*, Dr. Erwin M. Atzinger, AMSAA.

Donald S. Bloch, U.S. Army Logistics Center, chaired a panel discussion on Problems in Economic Analysis. A second panel discussion, convened as part of one of the special sessions, was devoted to a discussion of Analytical Capabilities Versus Requirements.

9th Annual PM Conference Speakers Continue High-Level Dialogue

(Continued from page 1)

progress in this area—project managers were still not giving this subject adequate attention. This situation must be improved in light of the many new systems due to be fielded in the next five years.

Turning then to the issue of "RSI," the General noted that his perception of how DARCOM was progressing in this field had changed over the past few weeks. "But today I have to tell you that recent experiences in reviewing a proposed system procurement plan have forced me, reluctantly, to conclude that we haven't been as successful in creating that awareness as I had thought."

The relationshiip of DARCOM managers with TRADOC's system managers was vastly improved, and the usefulness improved, said Guthrie.

Further, improvements must still be made, said the DARCOM commander, in cost control—cost conscientiousness as well as cost consciousness.

By way of something new, he noted the growing need to consider energy conservation in every aspect of DARCOM's activities—something that must be done better and with consistency, as it will have a significant impact in competition for funds.

Another area of concern to GEN Guthrie was that of dollar growth in product improvement. Similarly, the impact of the President's anti-inflation program on DARCOM's activities, said Guthrie, was greater than was realized initially. The intent to use government contracting as a club to obtain adherence by industry was evident, though the mechanism and data to support such actions were unclear.

It was of vital importance, continued the General, that every military member of DARCOM be informed and understand the new Civil Service Reform Act, as it will have significant impact on their personnel structure and problems.

In conclusion, GEN Guthrie stressed that DARCOM's goals for 1979 were the same as those of GEN Rogers, the Army Chief of Staff. "Aggressive support" was the term GEN Guthrie used to describe the way he felt DARCOM should carry out its effort—not only in the area of field service but in R&D and in industrial relations. "We must bend every effort to field equipment on schedule—or on a compressed schedule; we may have to take some risks, but only after we have identified and judged them."

Following short informal remarks by LTG D'Ambrosio, LTG Baer, and MG Bergquist, DARCOM deputies, on their respective areas of interest, the meeting entered the first of its RSI oriented presentations. BG Charles W. Dyke, chief, International Rationalization Office, ODCSOPS, DA, and Mr. Bryant K. Dunetz, assistant deputy, Materiel Development—International R&D, HQ DARCOM, then jointly covered current policies and trends in RSI.



LTG Eugene J. D'Ambrosio
DARCOM DCG for Materiel Readiness

BG Dyke noted the serious problems of getting all concerned to "sing from the same sheet of music." He stressed that RSI was not a momentary whim that would pass in time. Commitment to such a course had begun before the Carter Administration assumed office. Since then there has been a growing emphasis. Further, the Culver-Nunn Amendment makes clear the interest of the Congress in such activities.

Mr. Bryant Dunetz' portion of the presentation covered first, how the problem of RSI was studied by HQ DARCOM and an organization formulated to deal with it. Second, he reported on the findings and recommendations of the recent Defense Science Board Meeting, a meeting at which all levels and disciplines of government and industry were participants. The major issues, according to the Board's findings, were third country sales and technology transfer—its long term economic impact on U.S. commercial markets.

The recommendations of the Board, said Dunetz, were that a comprehensive policy statement was needed from the Secretary of defense, that codevelopment and coproduction seemed to be the most feasible approaches toward RSI, and that interoperability planning be given greater emphasis.

Commenting on the Military Staff Talks and DARCOM, Mr. Dunetz noted their awareness of the need to attain a common position on the threat, on joint concepts, on joint requirements, and on materiel cooperation to attain standardization and interoperability.

Following a luncheon on the first day, Dr. Percy A. Pierre, Assistant Secretary of the Army for Research, Development, and Acquisition, addressed the group. His first point was the constant need for the RDA community to remain mindful of the fact that the Army is a people-oriented service. While the Army is becoming more technology oriented, it will always remain primarily a people-oriented service. Therefore, the hardware developed must be useable as intended; its effectiveness hinges on this.

The Assistant Secretary then expressed his belief in the high caliber of personnel in the project manager field, but he felt a concern about how young officers might obtain access to this "PM" ladder.

Noting the personnel difficulties facing the Army, Dr. Pierre called attention to

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GLOSSARY OF ACRONYMS:

AAH—Advanced Attack Helicopter
AAH—30mm—30mm Ammunition
ACODS—Army Container Oriented Distribution System
ACVT—Armored Combat Vehicle Technology
ADTDS—Air Defense Tactical Data Systems (Missile Minder)
ARTADS—Army Tactical Data Systems
ASE—Aircraft Survivability Equipment
ASH—Advanced Scout Helicopter
ATACS—Army Tactical Communications Systems
ATD—Armor Training Devices
ATSS—Automatic Test Support Systems
AWC—Amphibians & Watercraft
CAC—Control & Analysis Centers
CAWS—Cannon Artillery Weapons Systems
CE—Commercial Construction & Selected Material Handling Equipment
CH-47M—CH-47 Modernization Program
CHAP/FAAR—Chaparral/Forward Area Alert Radar
DCSCS—DCS (Army) Communications Systems
DIVAD—Division Air Defense Gun
EAC—Echelon Above Corps
FAMECE/UET—Family of Military Engineer Construction Equipment/Universal Engineer Tractor
FVA—Fighting Vehicle Armament
FVS—Fighting Vehicle Systems
GLD—Ground Laser Designators
GSRS—General Support Rocket System
HELLFIRE—Heliborne Laser Fire & Forget Missile System
HELS—High Energy Laser System
HET—Heavy Equipment Transporter
IAP—Iranian Aircraft Program
ITV—Improved TOW Vehicle
KMS—Kuwait/Jordan Missile Systems
M110E2—8″ Howitzer
MEP—Mobile Electric Power
MSCS—Multi-Service Communications Systems
NAVCON—Navigation Control Systems
NUC MUN—Nuclear Munitions
PBM—Munitions Production Base Modernization & Expansion
PLRS/TIDS—Position Location Reporting System/Tactical Information Distribution Systems
REMBASS—Remotely Monitored Battlefield Sensor Systems
2.75 RS—2.75 Rocket System
RPV—Remotely Piloted Vehicles
SANG—Saudi Arabian National Guard Modernization Program
SEL AMMO—Selected Ammunition
SEMA—Special Electronic Mission Aircraft
SINCGARS—Single Channel Ground & Airborne Radio Subsystem
SMOKE—Smoke/Obscurants
SOTAS—Stand-Off Target Acquisition/Attack System
TACFIRE/FATDS—Tactical Fire Direction System/Tactical Information Distribution Systems
TADS/PNVS—Target Acquisition Designation System/Pilot Night Vision System
TMAS—Tank Main Armament Systems
TOS/OITDS—Tactical Operations System/Operations & Intelligence Tactical Data Systems
TRADE—Training Devices
VIPER/AHAMS—Viper/Advanced Heavy Antitank Missile System

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AAH	AAH–30mm	ACODS	ACVT	ADTDS	ARTADS
					
BG Edward M. Browne	LTC Daniel J. Delany	COL William H. Danzeisen	LTC Robert L. Catron	COL Eugene Fox	BG Donald R. Lasher

CAWS	CE	CH–47	CHAP/FAAR	COBRA	COPPERHEAD	DCSCS
						
COL Ronald E. Philipp	LTC Raymond F. Vachon	COL James M. Hesson	COL Harold E. Stubbs	COL Jay W. Pershing	LTC Robert A. Nulk	BG Emmett Paige

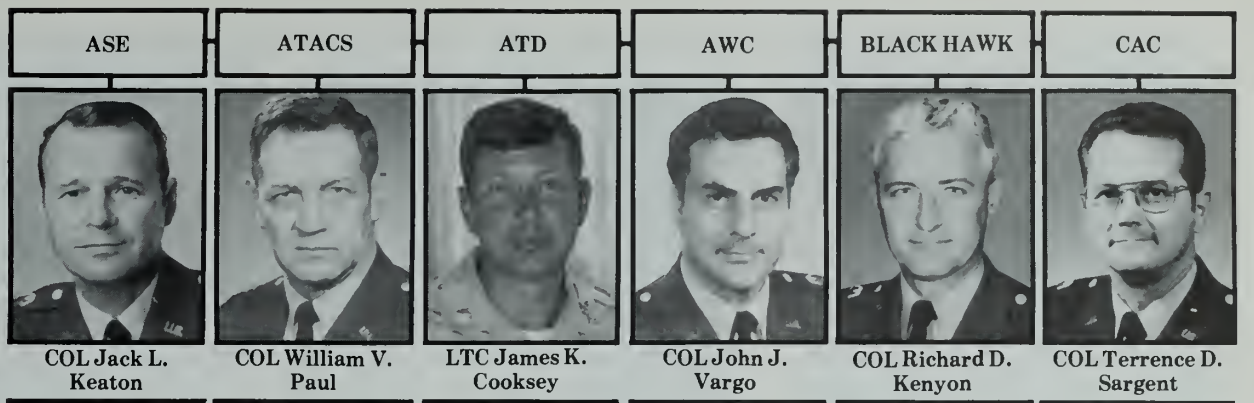
HAWK	HELLFIRE	HELS	HET	IAP	ITV	KMS
						
COL Howard C. Whittaker	COL Robert J. Feist	COL Dirk H. Lueders	LTC James H. Durham	COL John D. O'Donohue	COL Charles C. Adsit	COL Monte J. Hatchett

NUC MUN	PATRIOT	PBM	PERSHING	PLRS/TIDS	REMBASS	2.75 RS (acting)
						
COL James H. Sloan	MG Oliver D. Street	COL Harry V. Dutchyshyn	COL Larry H. Hunt	COL Robert D. Morgan	COL Louis C. Friedersdorff	John J. Harrity

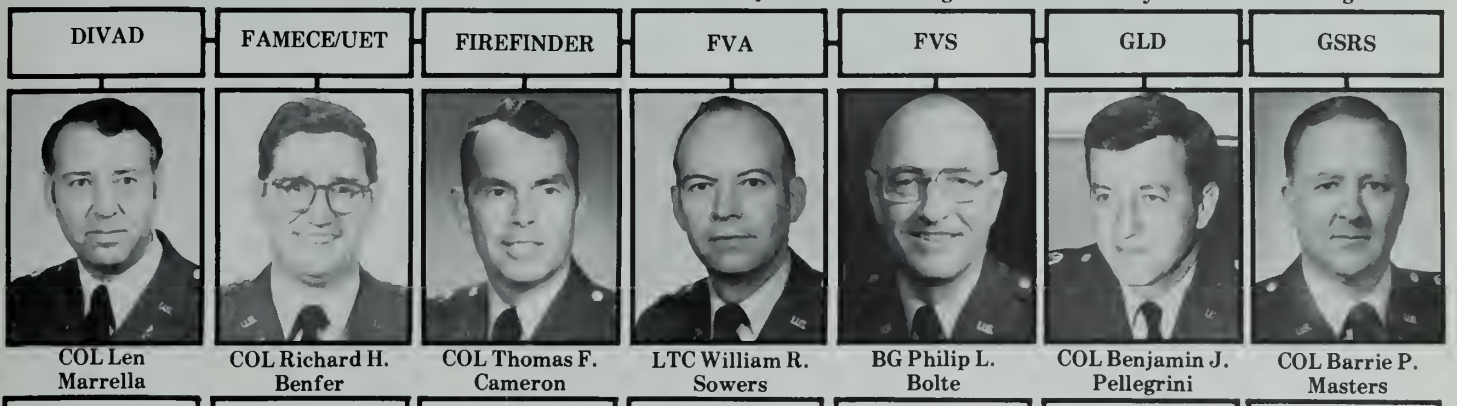
SOTAS	STINGER	TACFIRE/FATDS	TADS/PNVS	TOS/OITDS	TOW/DRAGON	TRADE
						
COL August M. Cianciolo	COL Vincent P. DeFatta	COL Jerry M. Bunyard	COL Clarence A. Patnode	LTC Alan B. Salisbury	COL Neil S. Williamson III	COL Boris Pogoloff

ram/Project gers

ges are the Army's project managers, hose charters or g. This data is cor- 8. For any further program/project nquiries should be s M. Eek Jr., chief, Management, HQ 284-9571 or com-)



COL Jack L. Keaton | COL William V. Paul | LTC James K. Cooksey | COL John J. Vargo | COL Richard D. Kenyon | COL Terrence D. Sargent



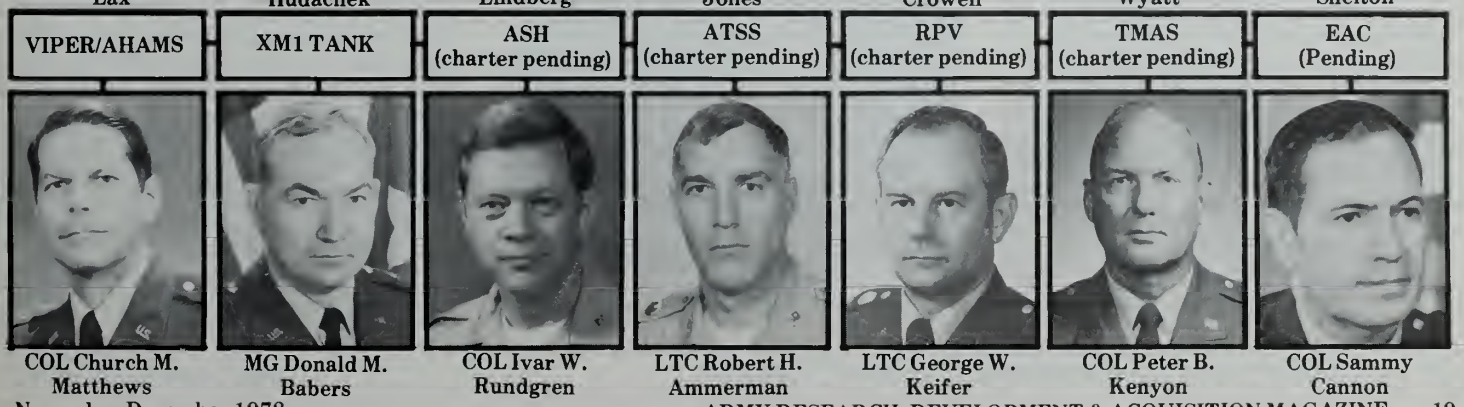
COL Len Marrella | COL Richard H. Benfer | COL Thomas F. Cameron | LTC William R. Sowers | BG Philip L. Bolte | COL Benjamin J. Pellegrini | COL Barrie P. Masters



COL Howard C. Jelinek | COL Richard H. Sawyer | LTC Nicholas R. Hurst | COL Robert E. Butler | COL Alvin G. Rowe | COL Anthony F. Albright | COL LeRoy White



BG Joseph O. Lax | BG John W. Hudachek | COL Charles F. Lindberg | COL Clifford Jones | COL William B. Crowell | COL James E. Wyatt | COL Henry R. Shelton



COL Church M. Matthews | MG Donald M. Babers | COL Ivar W. Rundgren | LTC Robert H. Ammerman | LTC George W. Keifer | COL Peter B. Kenyon | COL Sammy Cannon

9th Annual PM Conference Speakers Continue High-Level Dialogue

(Continued from page 17)

the potential benefits of utilizing the special category of Public Law 313 scientific and technical appointees. These specialists, because of their unique skills, had to be used judiciously.

The Army Science Board, continued Dr. Pierre, was always available to assist the RDA community. Those things they would be available to assist with included technology reviews of major Army programs, to look at technological alternatives. They had already been used as a source of high level personnel recommendations and for the review of the Army's laboratory 6.1 and 6.2 efforts. The Board would not, he stressed, be an adjunct for manpower shortages, to make routine reviews, or to be technical consultants.

The single priority he had in mind when he assumed office, said Pierre, was to see that the R&D system was productive. There had been an active research effort, he noted, for a number of years, but the flow of successfully fielded products had been weak. Much of our current equipment is outmoded technology, he continued, unsuited for an Army of the 1980s. However, the Army is now at the point where it is asking the Congress to invest heavily in a number of modern, developing systems that will be entering the inventory over the next two years.

This raised the point, said Dr. Pierre, of the so-called procurement problem or bow wave. It was his belief that the Army's position should be not to consider it an Army problem as such, but to apprise those whose business it is to make the final decisions, just what the Army's full needs are, in a well articulated, well defined and well presented case. The judgment and determination would then be made on a higher level, based upon a broad factual basis.

Dr. Pierre, in speaking briefly of RSI, noted that there has been considerable progress over the past year in translating rhetoric into documentation and guidance. He remarked that the so-called "Family of Weapons" concept being evolved, in contrast to the heretofore case-by-case approach, has implicit benefits.

Other points made by Dr. Pierre included his strong belief in the competitive approach, and his belief in the success of Army's project manager system.

Dr. Pierre closed his remarks by singling out for special recognition BG Edward M. Browne, program manager, Advanced Attack Helicopter and COL Richard D. Kenyon, project manager, Blackhawk. (See p. 1 for details of the award.)

Afternoon presentations of the first day included "TSQ-73 Case Study—Overview" by BG Donald R. Lasher, project manager, ARTADS, and "British FH70 Management Program" by Brig. Alan Wheatcroft, 155mm systems manager, British FH70 Program.



Brig. Alan Wheatcroft
British FH79 Program

Both presentations were extremely pithy and well received by the audience, in that they pointed out lessons learned and avenues for solution to unique problems.

Brig. Wheatcroft's talk was particularly notable and useful in that it was a case history approach involving three nations—the UK, the Federal Republic of Germany, and Italy, in the development of a new 155mm howitzer. On the disadvantage side, Brig. Wheatcroft noted that such programs take a greater length of time; in this case the production costs were greater than a unilateral program would have incurred; there was a trend to over- sophistication in order to meet multi-national requirements; there was a loss of national accountability, and a loss of national technology and expertise in some areas.

On the plus side, he noted there was a sharing of development cost; there was therefore, an easier mechanism for the British Army to rearm itself with a new weapon; there was an accumulation of wisdom; there were political spin-offs of advantage to all; and finally, the program provided a mechanism or trigger whereby future similar programs could be undertaken.

A panel session followed in which PMs of five different U.S. programs with varying RSI implications presented summaries of their experience. The moderator was BG(P) Frank P. Ragano, commander, MIRADCOM. Panel members were: COL Leonard S. Marrella, PM-DIVADS; COL Barrie P. Masters, PM-GSRS; COL Church M. Matthews, PM-Viper/AHAMS; COL James E. Wyatt, PM-SINCGARS; COL Vincent P. DeFatta, PM-Stinger; and Brig. Alan Wheatcroft, PM-FH70.

The morning's presentations of the second day were begun by BG Alfred J. Cade, acting DARCOM comptroller. BG Cade noted that too often comptrollers were viewed as dull, unresponsive folks, roadblocks to program accomplishment. In rebuttal of this, BG Cade noted that he was most impressed by the very high level of competency of DARCOM's comptroller personnel, command-wide. They represented, in contrast to an impediment, a vast untapped reservoir of talent who can assist the PM. Rather than waiting until one is in trouble before visiting the "senior comptroller in residence," said Cade, seek him out in the planning stage, for his knowledge and wisdom may provide ways and means to foresee potential financial difficulties. Cade urged the PMs to keep the comptrollers involved.

COL James L. Tow, Battlefield Systems Integration Directorate of HQ DARCOM, introduced the film "The Central Duel" by way of illustrating how BSI attempts to determine gaps in materiel and technology and provide solutions, recognizing the important interactions of all systems in the battlefield.

A presentation by COL Boris Pogoloff, project manager, TRADE, and members of his staff followed, in which he covered in brief, the capabilities of TRADE, and then gave examples on ongoing training devices as well as some of those under development.

The growing awareness of the need for improved training in light of rising costs, space limitations, energy conservation, etc., is reflected, said Pogoloff, in the growth of his budget—$22 million in 1973 to $132 million in 1979, and $235 planned for 1981. The group was given a brief demonstration of the basic technology of the MILES—Multiple Integrated Laser Engagement System, and then a view of systems now using this technology and those planned.

Similarly, the audience received a rundown on the uses of the Synthetic Light Training Systems and of Armor Training Devices.

The thrust of the next presentations took a different direction, with Mr. Harry K. J. Bukowski's discussion on "ILS Execution." Bukowski, deputy director, DRCRE, HQ DARCOM, gave the first of three talks on the general subject of logistics support. His presentation stressed the vital need for project managers to start their ILS planning very early in their program. A lively and profitable discussion session followed, covering such aspects as feedback, front-loading, and finding ingenious ways to solve ILS problems.

The luncheon speaker on the second day was LTG Donald R. Keith, Deputy Chief of Staff for Research, Development, and Acquistion. General Keith talked on the



Thomas S. Hahn
Congressional Interface

issue of RSI as he saw it from the Army staff level.

LTG Keith began by stating that he would have to confirm the perception already stated by others, that RSI was not a whimsical fancy but a fundamental part of the materiel acquisition business, with both the executive and legislative branches of the government having gone on record favoring it.

He noted, however, that Congress had tied RSI closely to readiness, and therefore he felt that they would use this in concert with other reasons, to address future RSI actions on a case-by-case basis rather than a *carte blanche* approval.

BG Keith remarked that he believed U.S. industry had now moved from a position of "active opposition to cautious support."

Early consideration of RSI in a development program is now part of the process, said Keith. There will be a tailoring to each project, he continued, but there would be no wasting of time with "obvious losers."

A spirited exchanged followed the presentation by Mr. Thomas S. Hahn, counsel for the Congressional Special Subcommittee on NATO Standardization and Interoperability and Readiness, and present staff member, House Armed Services Committee. Hahn noted current Congressional attitudes and concerns, and the seeming conflict between the Culver-Nunn Amendment. The latter is law, while OMB A-109 is a directive. In so far as conducting competition in RSI, competition is a key element of A-109, but it is not normally a part of European R&D.

It was his belief that Congress would look at RSI with ever-increasing interest and concern, as all aspects and implications emerged. One has to realize, he noted, that the House Armed Services Committee was viewing RSI in concert with readiness, and that their concerns were on long range implications of the impact on U.S. jobs and of technology on the American market place.

The topic of "Provisioning," the second of the three logistics presentations, was covered by Mr. Marion I. Hinson, deputy director, DRCMM, HQ DARCOM, and he was followed by COL Howard C. Whittaker, PM-Hawk, whose topic was 'Provisioning—Lessons Learned." The post-presentation question and answer sessions triggered great response from the PMs in airing concerns, gaps in understanding, and exchange of views over problems relating to ILS and development planning.

The wrap-up presentation of the second day was a review by Mr. James F. Machlin, assistant deputy for Materiel Readiness, HQ DARCOM, on the Civil Service Reform Act of 1978.

The formal banquet that evening, attended by 135 PMs, wives, and guests, heard GEN Frederick J. Kroesen, Vice Chief of Staff, U.S. Army, express his concern that tomorrow's soldiers receive new modern equipment of a type that they can use, maintain, and repair.

Citing a recent television show in which a private arms supplier stated his opinion of the superiority of Soviet small arms, and the high quality of their weapons in general, and the preference of the supplier's buyers for Soviet materiel, General Kroesen noted that the U.S. soldier has no open market place from which to purchase a preferred weapon. Rather, he must accept what the Army's RDA community provides him.

Today's Army, said the GEN, is equipped for the most part, with weapons and materiel that represent 25 to 30- year-old technology. While there are TOWs, Dragons, night vision systems, and a few other recent developments in the hands of troops, the bulk of their equipment is of old design: M60 tanks, Huey helicopters, and 5-ton trucks that are older than their drivers, and mortars born of the Korean War era.

He noted that GEN DePuy had pointed out when he was commander of TRADOC, that the Army was becoming more and more equipment and system oriented. GEN Kroesen remarked that this was a condition he felt was caused by the excessive belief that machines can replace men.



Oliver C. Boileau
President, Boeing Aerospace



INFORMAL DISCUSSION. MG Robert J. Lunn, DARCOM director of Development and Engineering; LTG Robert J. Baer, DCG for Materiel Development; and MG S. C. Stevens, AVRADCOM commander.

Rather, said Kroesen, wars are won by men, on the ground, aided by equipment. And the equipment, he continued, is only as good as the soldier who uses it.

While the soldier's ability to use technology progressess at an arithmetic rate, contended Kroesen, technology provided him is advancing at an algebraic rate. Today's soldier, he believes, is just as good as any generation American soldier, but as an 18 or 19-year old he will retain the characteristics of a young man or woman of that age, whether it be today, 1984, or thereafter. Therefore, there is the need to "soldier-proof" our equipment.

GEN Kroesen noted that in his new position as Vice Chief of Staff, he would also be the chairman of future ASARCs, a task he was just learning about, but with great interest. He recalled that last year GEN Kirwin, his predecessor, had spoken at the banquet and had reflected some of his deep concerns. GEN Kroesen said he had read Kirwin's remarks, and he believed they were generally valid today, particularly as they reflected on the importance of the role of the project manager in the materiel acquisition business.

However, the General stressed that he has been disappointed with the flow of good new systems from the research and development side of the Army's house to the field over the past 20 years. In his new capacity he intended to change that condition. He closed his remarks by saying his 20 years had just begun.

The final day's presentations were begun with a talk on "New Initiatives in Quality Assurance" by Mr. Seymour J. Lorber, director, Quality Assurance, HQ DARCOM. Lorber's talk was directed toward acquainting the PMs with problems encountered at his level and actions taken to assure high quality control of delivered products—both new items fresh from R&D and re-procurement items. Again,

(Continued on page 30)

RAM/Log Helps in Chinook Modernization

By COL William E. Crouch Jr.

The CH-47 (Chinook) helicopter modernization program is the latest to use the recently implemented reliability, availability, maintainability, and logistics (RAM/Log) data collection system. The system consists of prearranged codes, computer software, and a set of forms designed to collect data which describe the maintenance and operational history of each aircraft and its major components. After the data are collected, they are stored in a computerized data base and are used to determine the RAM and logistics as well as other vital information.

The RAM/Log system was initially developed by the U.S. Army and was implemented by the U.S. Army Aircraft Development Test Activity (USAADTA) at Fort Rucker, AL, for use in the UTTAS competition. It has also been used on the AH-1S and Iranian 214A tests and is currently being used on the Black Hawk and Advanced Attack Helicopter programs.

The CH-47 Modernization Project Manager's Office requested that the U.S. Army Test and Evaluation Command (TECOM), USAADTA's headquarters, be the executive agency responsible for the RAM/Log data collection. TECOM directed USAADTA to implement the test program.

The fleet of CH-47A, B, and C models are to be updated to the D model configuration, and the RAM/Log data collection system is the mechanism being used to establish a comprehensive data base for the C and D models. RAM/Log indices for the CH-47D will be developed and compared to those presently being collected for the CH-47C to measure the level of improvement achieved by the modernization program.

Reliability objectives are stated as measures of performance which must be demonstrated by the CH-47D. The research and development contract to modernize the CH-47s also includes an incentive to be awarded to the contractor based on the level of reliability and maintainability achieved.

USAADTA established the CH-47 RAM/Log Data Branch in January 1978 with functional responsibility for the data collection program. This branch is manned by soldiers with aviation maintenance backgrounds who have been trained as data collectors.

Because the RAM/Log system is complex, both classroom and on-the-job training was required for the collectors. The classroom training consisted of familiarizing the collectors with the format of the data forms, the types of data to be recorded on the forms, and the prearranged codes to be used when recording the data. These prearranged codes are a form of shorthand which provides a consistent set of notations essential when using the computer to assist in the analysis.

On-the-job training consisted of the collectors observing the maintenance and flight crews and filling out the forms. The forms were then checked for accuracy and completeness. Further classroom discussions were necessary to answer questions and discuss problems which arose during the practical situation.

As a result of this special training and their aviation maintenance backgrounds, the collectors can observe the maintenance and flight crews performing their duties and record the RAM/Log data without interrupting the operation or maintenance functions.

Actual data collection began in April 1978, and the initial effort is centered around two CH-47C helicopters which are scheduled to fly six hours each day for a 2-year period. The project manager will enter two CH-47D helicopters into the data collection when these aircraft become available.

The RAM/Log data collectors acquire information anytime there is activity taking place on either of the test CH-47s because the collectors fly with the aircraft as well as observe all ground activities. Data recorded include flight times, maintenance times, number of men performing maintenance, quantities



COL WILLIAM E. CROUCH JR., commander, U.S. Army Aircraft Development Test Activity, Fort Rucker, AL, is a 1951 graduate of the U.S. Military Academy with a commission in Artillery. He holds a master's degree in aeronautical engineering from Mississippi State University. Prior to joining the Aircraft Development Test Activity, he served as chief, Air Mobility Division and later as chief, Aviation Systems Division in the Office of the Chief of Research and Development, Department of the Army.

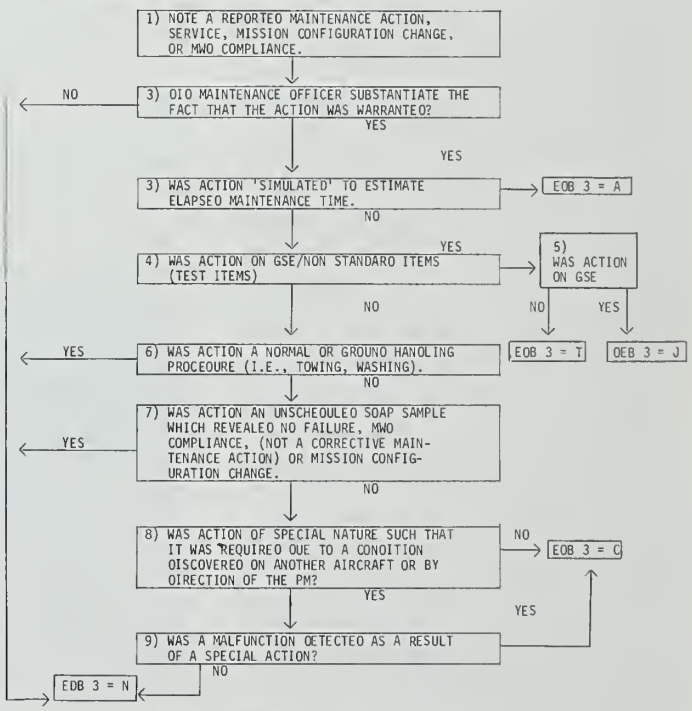
of consumables used such as oil and fuel, parts used and serial numbers of these parts, types of failures, and any other pertinent data which describe the maintenance and operating history of the aircraft. Comments of the flight and maintenance crews are recorded as are the observations of the data collectors.

After the collectors have completed the forms, an initial data quality control review occurs. During this review, the shift supervisor checks the forms for inconsistencies and missing data. Since the data collection is centered around two aircraft, and there may be several activities taking place on each of them, there will be periods when several collectors are observing and recording data simultaneously.

Completed RAM/Log data forms are sequential and are cross-referenced when there are related activities; therefore, the shift supervisor must be cognizant of the various activities so that he can assure that the forms are properly related to each other.

When the forms have been reviewed by the shift supervisor, they are screened by a committee of senior personnel who have an overview of all the activities associated with each aircraft and who provide continuity between shifts. The committee checks the forms for correct sequence, cross reference, and inadvertent errors.

In addition to the quality control screening, this committee also does the initial scoring of both flight and maintenance events. When flights are cancelled or aborted, the committee determines whether the abort is chargeable to the aircraft or is due to some other reason. Maintenance actions are also reviewed to deter-



Flow Diagram for Task Chargeability

mine if there was a malfunction chargeable against the aircraft and whether maintenance times are chargeable in assessing maintainability.

All scoring decisions are based on failure definition and scoring criteria reflected in flow diagrams. These diagrams help provide continuity and traceability to the scoring process by reducing the scoring decisions to a series of discrete yes or no answers. An example is shown in the accompanying flow diagram. This scoring is important because these chargeable actions are used to determine the RAM indices which measure how well the aircraft performed.

After the scoring is completed, the data on the forms are transcribed to punched cards and fed into the computer which performs additional quality checks. Corrections are made and are added to the data base. After the RAM/Log data are stored, the computer software generates reports for RAM experts and logisticians to perform their jobs.

RAM/Log, like any data acquisition system, has some drawbacks. One might ask why the Army Maintenance System (TAMMS) is not being used to acquire the data mentioned above. The answer is simply that while TAMMS acquires some limited RAM and logistics data, it was not designed to satisfy the detailed information now required in the materiel acquisition process.

RAM/Log data can be reconstructed into a complete time history of the aircraft and its major components. The TAMMS data, on the other hand, do not provide as complete a time history. The process of screening, scoring, and storing RAM/Log data takes about four days.

It would take several months for a TAMMS-recorded event to become a part of the data base. RAM/Log data are structured to permit identification and association of related maintenance actions, a process necessary when constructing a comprehensive record of operation, maintenance, and logistics; TAMMS data are not so structured.

Several quality reviews are made to assure that the RAM/Log data being collected are of high quality. TAMMS data are not subjected to similar quality control procedures and are, therefore, more likely to have inaccurate and inconsistent entries.

Although the RAM/Log data collection system has drawbacks, it is the best method available to the Army today to gain a clear, accurate, comprehensive insight into the reliability, availability, maintainability, and logistics aspects of newly developed systems. This insight is necessary to assure that the Army acquires materiel that will be available to do the mission, is reliable in performing that mission, and is logistically supportable.

A Glance at. . .

The U.S. Army Fuels and Lubricants Research Laboratory

The U.S. Army's Fuels and Lubricants Research Laboratory, now in its 21st year of existence, continues to respond to a broad program of military and civilian requirements ranging from field application studies to basic fundamentals of lubrication and combustion.

An in-house facility of the U.S. Army Mobility Equipment Research and Development Command, the Fuels and Lubricants Research Laboratory (AFLRL) is operated by Southwest Research Institute—a nonprofit corporation located at San Antonio, TX.

Thirteen chemists and engineers are permanently assigned to the laboratory, with an additional 24 support personnel. There are also 10 professional staff and six support personnel available, if needed, to carry out the AFLRL program.

As a basic element of Southwest Research Institute's Mobile Energy Division, the Fuels and Lubricants Laboratory performs its program under technical administration of MERADCOM's Energy and Water Resources Laboratory.

MERADCOM, a subordinate command of the Army Materiel Development and Readiness Command, has the lead responsibility for Army fuels and lubricants research and also cooperates with other Department of Defense and government agencies in this field.

In general, program objectives of the AFLRL are based on criteria such as energy shortages, changes in refinery techniques, fuel safety demands, environmental quality control, advanced fuel/energy systems, and requirements for advanced lubrication concepts. The current program is specifically directed at:

- Increasing fuel availability through adaption of high-sulfur diesel fuel and improving diesel fuel storage stability.
- Development of fuels and fluids which are safer under crash or ballistics impact conditions.
- Combustion process characterization of current and future fuels relative to energy, performance, and emissions.
- Development of a multiseasonal engine/power transmission lubricants which will satisfy all Army combat, tactical, and engineer equipment needs.
- Field applications stressing fuels and lubricants in real world environments.

FACILITIES. Three buildings comprising approximately 27,000 square feet of space contain the physical assets of the Army Fuels and Lubricants Research Laboratory.

AFLRL's administrative laboratories building, completed in 1957 and containing about 5,000 square feet of floor space, houses the Analytical laboratories, inspection/clean room, file room, and a conference room.

A new Chemical/Analytical Laboratory was completed in January of 1978 and occupies about 7,200 square feet. This facility contains an Analytical Instrumentation Laboratory, a Rheological Laboratory, and offices.

Approximately 4,500 square feet in the new laboratory are devoted to the Analytical Instrumentation and Rheology Laboratories. Studies are conducted to determine the chemical composition structure, and characteristics of new and older petroleum compounds as well as fuel and lubricant additives and combustion products.

A unique high-pressure turbine combustor is another recent addition to the Army Fuels and Lubricants Research Laboratory. This facility provides the Army with the first research combustor system designed specifically to simulate the environment and the ranges of flow, pressure, and temperature for which Army turbine engines were designed.

The combustor will operate airflow rates of up to 2.5 lb/sec, inlet temperatures up to 1500°F, and pressures up to 16 atmospheres. This equipment is particularly important for assessing Army turbine engine fuel requirements and emissions performance.

AFLRL's engine and bench facility consists of seven individual cells each capable of single-engine operation, with two of the cells presently housing two small single cylinder research engines and bench combustion and lubrication apparatus.

All of these areas are designed so that utilities such as power, fuel and exhaust systems enter from beneath the flooring. This layout provides a clear, uncluttered working surface.

Research on alternative and synthetic fuels is also provided by two Enterprise model DSM-38 engine-generator sets. These engines feature an 8-inch bore and a 10-inch stroke, a 900-rpm operating speed, 8 cylinders, and a 710 rated horsepower.

Augmenting the above mentioned facilities, is an additional 12,400 square feet of administrative/laboratory space owned by Southwest Research Institute. Programs are keyed to the areas of aviation lubricant degradation, spline/gear wear studies, development of fuel composition scenarios, hybrid fuels, etc.

Insensitive Explosives Studied for Conventional Munitions Use

By LTC Raymond L. Anderson





DURING A BREAK at the Insensitive High Explosive and Propellant Study "kickoff" Meeting at Los Alamos, ARRCOM Commander MG William E. Eicher holds informal conversation with Leonard Ambrosini, ARRCOM deputy for Life-Cycle Management, and Dr. Harold M. Agnew, LASL director. Photo at right shows Dr. Agnew, Edward O. Chapin, a LASL group leader and study director, and Dr. Ruth M. Davis, DUSDRE (R&AT).

Concentrating high-explosive munitions on aircraft carriers, munition resupply ships, fighter and bomber aircraft, tanks, and self-propelled artillery and in ammunition storage and production facilities makes them highly vulnerable to destruction by detonation, whether by accident or enemy action.

History is replete with examples of munition disasters that might have been avoided or greatly reduced if less-sensitive high explosives and propellants had been used as munition fills. Today, the Department of Defense and the Department of Energy have a variety of explosives that offer not only respectable performance characteristics, but also extreme insensitivity to accidental initiation.

The Department of Defense, in agreement with the Department of Energy, has designated the Los Alamos (NM) Scientific Laboratory (LASL) as the lead organization for a study of the utility of these insensitive high explosives and propellants for conventional munitions.

The 6-month effort is being directed by Mr. Edward O. Chapin, a LASL group leader. A steering committee, chaired by Mr. Arthur Mendolia (former Under Secretary of Defense for Installations and Logistics), will provide guidance and assistance.

Members of the study group include Army, Navy, Air Force, Department of Energy, and industry personnel. Participating organizations represent the total U.S. expertise in conventional munitions.

Potential areas of the intensive study may include several of the RDX-explosive and HMX-based formulations which have been developed by the military and show great promise. Other materials, such as plastic-bonded triaminotrinitrobenzene, used by the DOE nuclear-weapon laboratories, are even more insensitive. All of these materials are much safer than more common high explosives such as Composition B and TNT.

Explosives test data—from simulated fires, handling and manufacturing accidents, aircraft crashes, and setback of projectiles—reveal that insensitive explosives, as compared with current ammunition fills, decrease the probability of explosive accidents by 10 to 100 times or more, depending on the application.

The so-called insensitive materials are not widely used in conventional munitions at present because of questions regarding such things as specific energies, explosion dynamics, and manufacturing and loading techniques.

Interest in using insensitive high explosives and propellants in conventional munitions was stimulated in late 1977 by discussions among Dr. Harold M. Agnew, LASL Director; Dr. Harold Brown, Secretary of Defense; and GEN George S. Brown, former Chairman of the Joint Chiefs of Staff.

Their conservations dealt with use of insensitive high explosives in nuclear munitions and the resulting payoffs in safety and reduced vulnerability.

At a later meeting, Dr. Agnew and GEN Alexander Haig, Supreme NATO Commander, discussed the subject in greater detail. LASL was subsequently asked, in early 1978, to prepare terms of reference for a proposed DOD program to study applications of insensitive explosives and propellants to conventional munitions.

Finally, in June 1978, Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology) Dr. Ruth M. Davis directed that a joint DOD-DOE- Industry study be conducted. Its purpose, she said, was to determine the utility of insensitive high explosives and propellants for use in DOD munition systems, and to identify technological challenges involved in bringing such use to fruition.

Dr. Davis recently emphasized the importance of the study to future, high-level DOD decisions. She believes the study could stimulate expanded research and development in the explosives field and eventually render numerous benefits to our Armed Forces.

The study task force is comprised of three major groups. An Analysis Group, led by Dr. John J. McCarthy of the U.S. Army Materiel Systems Analysis Activity, will screen conventional DOD weapon systems for their suitability to test the utility of selected insensitive fills. Utility criteria include reduction of vulnerability in combat, safety benefits, operational effectiveness and product costs, production base, and life-cycle support.

A Technology Assessment Group, under Dr. John W. Kury of Lawrence Livermore Laboratory, will evaluate technological implications for the near and longer-term utility of existing and prospective insensitive explosives.

The third group, headed by Dr. Rey Morales of Los Alamos Scientific Laboratory, will integrate all materials generated into a single, comprehensive report. Findings and recommendations are to be submitted to the Office of the Secretary of Defense by 1 Mar. 1979.



LTC RAYMOND L. ANDERSON has been assigned as an Army Research Associate at Los Alamos Scientific Laboratory since September 1977. Prior to this he was with the 59th Ordnance Brigade in Pirmasens, Germany. LTC Anderson holds a BA degree in chemistry from Washington and Jefferson College and an MS degree in nuclear engineering from the Naval Post-graduate School. He is a graduate of the Army's Command and General Staff College.

Moisture Conditions in Storage Shelters in Humid Environments

By Dr. Wilfried H. Portig



DR. WILFRIED H. PORTIG was employed, until his retirement in September, as a research meteorologist with the U.S. Army Test and Evaluation Command's Tropic Test Center, Panama, CZ. A native of Germany, he received his PhD in meteorology and seismology from the University of Hamburg in 1935. He is a recent recipient of TECOM's Edward H. Gamble Award for his scientific achievements related to water condensation in containers stored in tropic regions.

Crated goods are frequently exposed to the elements, either awaiting shipment or during transportation aboard container ships. After storage in the humid tropics of the Panama Canal Zone, some stored goods are observed to be extremely wet and are more or less useless. On other occasions, under conditions seemingly equivalent to those which resulted in water damage, the goods remain dry and in good condition. Why? The U.S. Army Test and Evaluation Command's Tropic Test Center, Panama, CZ, conducted a study to find the conditions under which water damage to crated equipment was likely to occur.

A group of different transportation containers was instrumented to record temperature and humidity of the enclosed air, and the wetness of selected places within the containers. Unfortunately, the wetness sensors were so badly damaged by water condensate that only a few recordings were usable. However, the temperature and humidity recordings provided enough clues to delineate the basic processes that cause water damage in containers. They also gave indications of how to prevent such damage, or at least how to reduce the probability of its occurrence.

An essential step was the replacement of relative humidity by absolute humidity as an indicator of conditions within the container. The latter is computed from the temperature and the relative humidity of the air. Absolute humidity tells directly how much water vapor (in grams) is suspended in a cubic meter of air.

Initially, there were two hypotheses concerning the absolute humidity of the air in closed containers. One held that absolute humidity is constant since the walls of the containers prevent the entrance of outside humid air or the escape of inside humid air. The second hypothesis propounded that there is a moisture exchange between inside and outside air. It is argued that the air in a container expands when it is heated, for instance, by the sun's rays. Expanding air escapes through openings such as cracks or irregularities at lids or doors, taking moisture out of the container. This is called exhaling, or breathing out. When the container cools, ambient air will be sucked in along with the water vapor suspended in it. This is inhaling, or breathing in.

The effect of breathing can be computed numerically when the absolute humidity is known inside the container at the time it is closed and when the changes of inside temperature and outside humidity are also known.

Comparison of such computations with measurements indicated that the actual conditions differ completely from the conditions expected under the breathing concept. Although the hypothesis predicted a decrease of absolute humidity during periods of rising temperatures (because air and its water vapor were exhaled), a substantial increase in absolute humidity resulted.

Through further experimentation two sources for the increase in humidity were found. All porous materials contain varying amounts of "absorbed" water. During periods of rising temperature some of the absorbed water in the materials vaporizes and is suspended in the air in the container. Since the warmed air can hold more water vapor than it could when it was cooler, it facilitates the movement of water from the materials to the air. This was demonstrated by weighing the material. When the absolute humidity of the air increased, the material decreased in weight, and vice versa.

In addition to absorbed water in materials, there is also adsorbed water on non-porous materials. Rising temperatures loosen the adsorption bonds as well as the absorption bonds. Thus, even an empty container with smooth, non-porous walls experiences an increase in the water content of the enclosed air during periods of rising temperatures. The effect of adsorption was also demonstrated through weighing, which required a more sophisticated method than the method of confirming the weight changes due to absorption.

The moisture movement from materials into the overlying air during periods of rising temperatures can frequently be reversed during periods of falling temperatures. However, there are exceptions. Excess water from the warm air can be trapped in places other than where it originated and subsequently cannot return to its original location.

It may condense when the temperature drops. In addition, inhaling may provide more moisture which, on a single day, may be a very small amount, but which accumulates as the days go by. Finally, there may be materials that readily dispose of their absorbed water but cannot readily reverse the process.

The problem of preventing water damage in storage or transportation containers in humid tropic environment boils down to the necessity of reducing the amount of water in the container. This can be done by closing the container in a dry ambient environment, such as an air conditioned warehouse.

Successful attempts to reduce the inside humidity have included predrying goods and/or the pallets on which they stand. There are reasons to believe that untreated (but not green) wood has a moderating effect on the moisture distribution in containers, whereas cardboard seems to complicate matters.

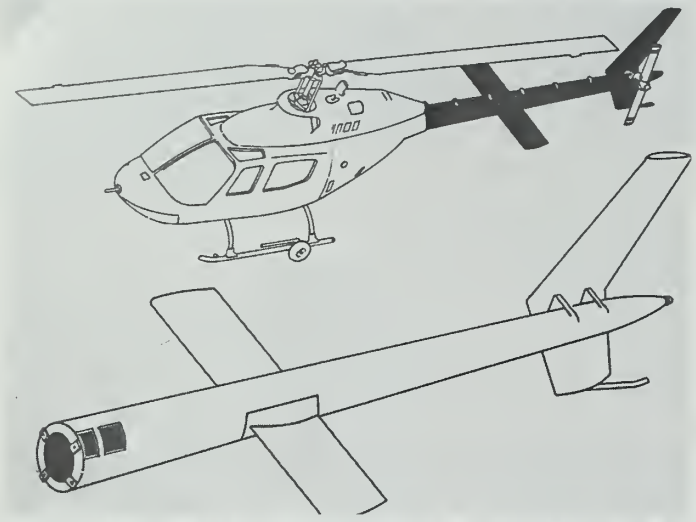
The experiment at the Tropic Test Center was a pilot study. After the basics of moisture movements in containers have been established, it is up to crating and packing engineers to find the most effective way to prevent water damage. In this context, it is comforting to know that cheap, untreated (but not fresh) wood seems to work better than other more expensive packing materials.

Capsules...

Helicopter Contracts Exceed $1.2 Million

Helicopter RDTE contracts totaling $1,250,733 were awarded recently by the U.S. Army Research and Technology Laboratories (RTL), AVRADCOM, NASA Ames Research Center, Moffet Field, CA.

Under a 55-month $910,000 contract, Hughes Helicopters will conduct a study called "Environmental Effects and Durability Evaluation of Advanced Composite Fuselage



Structures," to determine long-term effects of exposure to the natural elements (i.e., heat, cold, ultraviolet, etc.), coupled with daily service usage of advanced composite primary airframe structures.

Ten composite fuselage tail sections (tailboom, horizontal stabilizer, vertical fin) on OH–58 Observation Helicopters will be flown and maintained under actual service conditions by Army personnel for two years. Hughes personnel will periodically monitor and evaluate the structural characteristics of the composite tail sections and assess the long-term effects of environmental and service exposure.

Initial development will include design, fabrication and structural testing (both lab and flight demonstration) of four composite fuselage tail sections. The development and test experience gained from the manufacture of 14 composite units will provide information into the acquisition cost and establish a basis to develop similar structures for future production applications.

The 2-year evaluation of these airframe components in the field environment will demonstrate durability characteristics and permit assessment of maintenance techniques by Army personnel.

Composite airframe primary structures are reported to offer major potential improvements for future helicopters in weight savings, damage tolerance, cost savings and resistance to fatigue from vibration associated with rotary wing aircraft. Although composite rotor blades are in production, major experimental primary helicopter structural components have not been built and flown to the extent that a production commitment can be made.

Project engineer is Mr. L. Thomas Mazza; contract specialist for the program is Mr. Perry G. Foster. Both are with RTL's Applied Technology Laboratory, Fort Eustis, VA, the lab in charge of the contract.

A $145,733 one-year contract was awarded to Paragon Pacific Inc., to develop an Advanced Special Purpose Rotorcraft Simulator (SPURS-A).

Modeling of helicopter rotor dynamics for real-time, piloted simulation requires very rapid solution of rotor mathematical models. Restrictive assumptions on these models have been required to obtain real-time solutions with general purpose digital computers.

SPURS-A is a hybrid digital analog computer designed for real-time simulation of helicopters, while retaining such features of the rotor model as stall and compressibility. Flexibility will be retained in SPURS-A by the incorporation of automatic potentiometer setting.

Mr. Roger L. Smith of the Aeromechanics Laboratory is project engineer, and contract specialist for this program is Mr. Dennis Padilla, NASA Ames Research Center.

Franklin Institute Research Laboratories received $95,000, and the Northrop Corp. $100,000, to make a feasibility and conceptual study to determine the best method to adapt the NASA Ames Research Center's Vertical Motion Simulator for R&D studies that focus on Army helicopter operations.

The study will produce a motion system concept which best achieves: (1) A 4-axis motion, which will integrate with the two existing translational modes of the Vertical Motion Simulator; (2) a motion system which can be "easily" converted from a helicopter to a fixed-wing aircraft simulator and vice-versa; and (3) a motion system that interfaces with an advanced visual display system.

Project engineer Mr. Dennis Matsuhiro is with the Aeromechanics Laboratory; contract specialist is Mr. Terry Mahurin, NASA Ames Research Center.

Production of Circuit Boards Increased 10-Fold

A new process devised by two engineering technicians at MIRADCOM's Engineering Laboratory, Messrs. Raymond Aldridge and Edward Lang, will increase production of circuit boards by a factor of ten for the same investment of labor hours. MIRADCOM's Advanced Systems Development and Manufacturing Technology Directorate estimates a yearly savings of about $250,000 will result from the new process.

The new approach radically alters the manufacturing process by using a keying registration system which the two men found enabled them to use a step and repeat camera for projection of multiple images onto film from a single master phototool while maintaining critical accuracy.

Adoption of this process by other government agencies and by industry may follow.

Patriot Scores Direct Hit on F-86 Fighter Plane

Patriot, the Army's new plane killer, destroyed a pilotless F–86 fighter at White Sands Missile Range, NM, on 12 October in its first engagement equipped with new tactical guidance equipment and armed with a live warhead.

The plane, flying at low altitude and short range, in a counter-measures environment, suffered a direct hit and was completely destroyed. MG Oliver D. Street, III, Patriot project manager in Huntsville Research Park, said all test objectives were accomplished.

"We have gone from analog to a small digital computer in the Patriot guidance system," MG Street said, "and this

was the first engagement utilizing that tactical hardware. This was the first flight with a live warhead, also."

MG Street said the new Modular Digital Airborne Guidance System (MDAGS) equipment is easier to produce and maintain, is more reliable and will cost less in production than the old equipment.

Patriot is now undergoing the final phase of contractor development firings prior to beginning government testing and subsequently entering production.

Being developed to replace both Hawk and Mike Hercules, Patriot will be the cornerstone of field Army air defense against medium to high altitude aircraft in the 1980s and beyond. The mobile, all-weather system is believed to be the only air defense weapon of its kind under development in the Free World.

Raytheon Co. is Patriot prime contractor and Martin Marietta is principal subcontractor for the missile canister and launcher. Thiokol Co. is subcontractor for the single stage, solid propulsion unit.

Army Gets First Black Hawk Production Model

U.S. Army acceptance of the first production model of the UH–60A Black Hawk helicopter occurred recently during formal ceremonies in which the keys to the aircraft were accepted by DARCOM Deputy Commander for Material Development LTG Robert J. Baer.

Other participants at the acceptance ceremonies included Black Hawk Project Manager COL Richard D. Kenyon, U.S. Army Aviation Research and Development Command, St. Louis, MO, and Gerald J. Tobias, president of Sikorsky Aircraft.

It is expected that more than 1,100 of the utility transport aircraft, which are worth in excess of $2.5 billion, will be procured by the Army. Deliveries will reportedly continue through the mid 1980s.

LTG Baer noted at the acceptance ceremonies that the Black Hawk will replace the UH–1 or Huey helicopter in carrying out critical Army missions. "Since its start," he said, "this program has been structured to emphasize lessons learned from many years of helicopter experience."

Following the ceremony, COL Kenyon noted that the First Black Hawk production model will be turned back to the manufacturer for validation of production configuration and flight performance. He added that the Black Hawk is the first of a new generation of helicopters.

Three additional aircraft are scheduled for delivery before 1979, and the rate will increase to three per month during 1979 and to 14 per month by the early 1980s. A total of 46 are scheduled for delivery in 1979.

Small Business Contract Calls for 50 Applique Units

The U.S. Army Communications Systems Agency/Project Manager DCS (Army) Communications Systems has announced the award of an 8A "Set Aside" small business contract for approximately $350,000.

The contract awarded to West Electronics, Inc., calls for the production, engineering, fabrication, test and acceptance of 50 Secure Voice Switchboard Wideband Trunk Applique Units, Running spares, initial repair parts, and publications.

The $343,000 contract is for a Tri-Service project with 9 Applique Units designated for Navy use, 22 for Air Force use, and 16 for Army use. Also included are three first article units. The Applique Units will be installed at 37 sites worldwide.

Termed an improvement incorporated into the AUTOSEVOCOM I program, the new units will be able to monitor wideband truck signals at secure voice switchboards and provide status indicators and automatic supervision not presently available.

West Electronics, Inc., the recipient of the small business contract, is an electronics manufacturing firm owned by the Assiniboine and Sioux Indian Tribes. The 8-year-old firm is located on the Fort Peck Indian Reservation in northeastern Montana.

B-O 105 Flies With Bearingless Main Rotor



The first flight of a helicopter equipped with a bearingless main rotor system was conducted recently by the Boeing Vertol Co. at the company's flight test center in Wilmington, DE. Developed under a joint program with the U.S. Army, the bearingless main rotor system provides a 67 percent reduction in parts, compared with conventional rotor head systems. For stability and control of flight, conventional helicopters use as many as 24 bearings or hinged surfaces at the point where the blades are attached to the transmission shaft. The bearingless main rotor uses fiberglass blades bolted directly to the transmission shaft. Unlike metal, fiberglass blades bend to provide the necessary vertical and horizontal motions, and they can be twisted for pitch control, thus eliminating the need for bearings and hinged surfaces. During the flight, Boeing test pilots hovered the helicopter for 53 minutes at 400 rpm's, which is 97 percent of normal operating speed.

Army Contract for Night Sights Totals $6.2 Million

Production of AN/TAS–4 night sights, for use with the TOW guided missile weapon system, is called for in a recent $6.2 million contract awarded by the U.S. Army Electronics R&D Command, Adelphi, MD.

The night sights, which permit antitank gunners to easily detect and recognize targets at the full range of the missile at night, will be produced by Kollsman Instrument Co., a division of Sun Chemical Inc., Merrimack, NH.

These electro-optical systems are designed to operate by discerning small temperature differences between targets and their backgrounds. They are also capable of use during the day when other atmospheric obstacles may obscure vision.

The contract is believed to be the first ever with Kollsman involving the thermal series of night sights. Included in the contract are two options for additional purchases of night sights at a potential value of more than $45 million.



DOE participants. Front row: Dr. Ben Noble, MRC director; Dr. Grace Wahba, U. of Wisc.; Dr. Robert L. Launer, ARO; Dr. Frank E. Grubbs, APG; Dr. Bernard Harris, MRC; Dr. Walter Foster, AFIP. Back row: Dr. Ralph Bradley, FSU; Dr. Norman Draper, U. of Wisc.; Dr. Malcolm Taylor, BRL; Dr. James R. Moore, BRL; Herb Cohen, AMSAA; Jill Smith, BRL; Dr. Doug DePriest, ONR; Dr. Douglas B. Tang, WRAIR; Dr. Edward Wegman, ONR; Langhorne Withers, OTEA.

Design of Experiments Conference Inaugurates Tutorial Seminar

The 24th conference on the Design of Experiments (DOE) in Army Research, Development and Testing was held 4-6 Oct. 1978 at the Mathematics Research Center, Madison, WI. The DOE is one of three annual conferences sponsored by the Army Mathematics Steering Committee.

One of the main functions of the Steering Committee is to foster the systematic education of the Army R&D community in new mathematical theories and their fundamental role in scientific research. As a result of this mission, the subcommittee on Statistics and Probability organized a special tutorial seminar, "The Fundamentals of Experimental Design," which was held on the two days preceding the DOE Conference.

Special guest speaker for this tutorial seminar was Prof. George E. P. Box, who is the Ronald Aylmer Fisher Professor of Statistics at the University of Wisconsin and the Mathematics Research Center. Prof. Box has made numerous fundamental contributions to the theory and methodology of the statistical design of experiments, and is well known for his recent work in time series analysis. He is co-developer of the famous Box-Jenkins method of time series modeling. He has written five books in statistics including the recent one with William G. Hunter and J. Stuart Hunter, "Statistics for Experimenters."

The tutorial seminar was attended by approximately 40 Army scientists and engineers and about 15 students and faculty members from the University of Wisconsin. This year's tutorial was so successful that the Statistics and Probability subcommittee plans to adopt it as a regular feature of the DOE Conference.

Interested Army R&D personnel are urged to forward suggestions for future seminar topics to Dr. Douglas B. Tang, Walter Reed Army Institute of Research, chairman of the Subcommittee on Statistics and Probability, AV 291-2011 or Dr. Robert L. Launer, Army Research Office, AV 935-3331.

The theme of this year's DOE Conference was "Statistical Design and Analysis of Experiments." The keynote speaker was Norman Draper, University of Wisconsin, who spoke on "Ridge Regression." Other invited speakers and their titles were: Ralph Bradley, Florida State University, "Statistical Analysis of Weather Modification Experiments"; Grace Wahba, University of Wisconsin, "Design Problems in Recovering Functions of Two or Several Variables"; Brian Joiner, University of Wisconsin, "Statistical Consulting"; and Bernard Davis with Richard Barlow, University of California-Berkeley, "Recent Advances in Graphical Techniques for Analyzing Failure Data."

A special feature of the DOE Conference is the annual presentation of the Samuel S. Wilks Memorial Award, consisting of a medal, citation and an honorarium, for contributions to the advancement of scientific or technical knowledge in statistics. This year's award was given to Dr. William H. Kruskal, professor of Statistics at the University of Chicago. Dr. Kruskal is a Fellow of the American Statistical Association and a Fellow and past president of the Institute of Mathematical Statistics.

The DOE Conference began with a welcome by Dr. Ben Noble, director of the Mathematics Research Center. The conference chairman was Dr. Frank E. Grubbs, Aberdeen Proving Ground, MD, and the chairman for local arrangements was Dr. Bernard Harris of the Mathematics Research Center and the University of Wisconsin.

Titles of the technical sessions were: "Time Series and Stochastic Modeling"; "Analysis of Variance Models"; "Statistical Theory"; "Statistical Inference"; "Special Applications"; and "Material Reliability." The 25th DOE Conference is tentatively scheduled to take place at the Natick Research and Development Command 17-19 Oct. 1979.

Planning Briefing for Industry Believed to be Largest Ever

Nearly 600 persons, including representatives of 215 U.S. industrial and business organizations, attended a recent Advanced Planning Briefing for Industry at the U.S. Military Academy, West Point, NY. Sponsored by the U.S. Army Armament R&D Command, the meeting was believed to be the largest of its kind ever held by the Army.

Supporting ARRADCOM, which is responsible for armament systems R&D, were the armament user—the U.S. Army Training and Doctrine Command and ARRADCOM's parent command—the U.S. Army Materiel Development and Readiness Command. Administrative assistance was provided by the Military Academy, the National Security Industrial Association, and the American Defense Preparedness Association.

MG Bennett L. Lewis, ARRADCOM commander and conference host, told the audience that the Army wanted to "present to industry the ways in which the Army and industry can work together. . . by first educating you (industrialists) as to what the user needs are and then informing you of some representative development problems to see if you have any solutions."

He added that ARRADCOM needs more industrial support than in the recent past because "the number of Army personnel authorized for the armament program has been steadily decreasing since 1975."

In his overview of ARRADCOM, "the largest of the R&D commands under DARCOM," MG Lewis said that there are two major ARRADCOM links with industry—the Small Business Office and the Technical Industrial Liaison Office.

MG Lewis noted that "in FY78 over $30 million went to small businesses which was almost equally divided between research, development, testing and evaluation projects and those involving procurement acquisition. Forty percent of all unsolicited proposals which come to DARCOM arrive through ARRADCOM's Technical Industrial Liaison Office."

Among the total ARRADCOM dollars spent in FY78, he added, 75 percent was passed on to industry, 44 percent of it for R&D. Another 75 of the '79 budget is also slated to go to industry, with R&D money being increased to 52 percent.



APBI PARTICIPANTS included (l. to r.) BG David W. Einsel Jr., ARRADCOM deputy commander; MG William J. Livsey Jr., commander of the U.S. Infantry Center; GEN John R. Guthrie, DARCOM commander; MG Bennett L. Lewis, ARRADCOM commander; BG John W. Woodmansee Jr., the Army's assistant deputy chief of staff for Combat Developments; COL Edwin Saunders, head of the Department of Physics, U.S. Military Academy.

MG Lewis stressed that the Army wants to be assured that what it is putting into the field has a technical data package which assures long-term production, and that it will be capable of providing engineering support to the troops as long as an item is in the field.

Other key speakers included GEN John R. Guthrie, DARCOM commander, TRADOC Commander GEN Donn Starry, and BG John W. Woodmansee Jr., TRADOC's assistant deputy chief of staff for Combat Developments. Summaries of GEN Guthrie's and Starry's speeches appear on page .

The meeting also provided an opportunity to announce publicly, for the first time, the creation of a Tri-Service Industry Information Center at HQ DARCOM in Alexandria, VA. A second Tri-Service Information Center has opened at Pasadena, CA, and a third is to open at Wright-Patterson Air Force Base, OH, in FY79.

Mr. Richard C. Navarin, DARCOM technical industrial liaison officer and coordinator of the Army-hosted Tri-Service Industry Center, presented a brief discussion of Technical Industrial Liaison Office activities. He described the TILO's relationship with industry, the various R&D planning documents which are available for industry review, and the procedures for using the TILO.

The conference agenda also included six working sessions which were devoted to discussions of armor/antiarmor, artillery and air defense, infantry and systems support, chemical-biological projects, training, and manufacturing technology. Also featured were exhibits of numerous armament weapon systems and other high interest items.



DOCUMENTS, SERVICES and technical assistance provided by the Tri-Service Industry Information Center were publicized during the premiere of a special Technical Industrial Liaison Office (TILO) exhibit at the 1978 Annual Meeting of the Association of the U.S. Army in Washington, DC. Personnel were on hand from the various Services industrial liaison establishments to answer a wide variety of technical and operational questions. They included (l. to r.) Sylvia Hadowanetz, ARRADCOM TILO; Kay Rathgeber, ERADCOM TILO; Pat Eubanks, Navy NARDIC (Pasadena, CA); Robert Luttrell, MIRADCOM TILO; Rebekah Liller, Department of the Army TILO; Lillian Morris, Navy NARDIC (Alexandria, VA); and Hanna Kinley, Air Force IFIO (Alexandria, VA).

Secretary of the Army Visits Tri-Service Information Center

Secretary of the Army Clifford L. Alexander recently paid a brief visit to the Tri-Service Industry Information Center at HQ U.S. Army Materiel Development and Readiness Command, Alexandria, VA.

Staffed by U.S. Army, Navy and Air Force civilian information representatives, the Tri-Service Information Center is designed to assit industry in obtaining current Armed Forces R&D information and in viewing appropriate planning and programing documents.

The Army is host service at the Tri-Service Center in Alexandria, VA, which serves the East Coast. The Navy also hosts a Tri-Service Center in Pasadena, CA, and the Air Force plans to host a similar activity at Wright-Patterson AFB, Dayton, OH.

Secretary Alexander—who visited the Army-hosted Center in order to familiarize himself with its overall operation—was accompanied by DARCOM Commander GEN John R. Guthrie. Alexander expressed his interest in the Center and spoke briefly with each of the three Service representatives.

The Secretary was reportedly pleased that the three Services can effectively coordinate their efforts toward a common goal of providing R&D planning information to industry. He was advised that the Center has been operational for about a year and that interest in it has steadily increased as evidenced by the increasing number of visitors.

Mr. Richard C. Navarin, DARCOM technical industrial liaison officer, is coordinator of the Army-hosted Tri-Service Information Center. Service representatives are Mrs. Rebekah E. Liller (Army), Ms. Lillian L. Morris (Navy), and Ms. Hanna Kinley (Air Force).

9th Annual PM Conference Speakers

(Continued from page 21)

the advice was to plan early.

MG Robert L. Kirwan, commander, OTEA, then described to the audience his perception of the question as to whether the role of the operational tester was that of adversary or ally. He traced the background that led to the establishment, by all services, of independent testing agencies.

He was aware of a number of frequently contentious issues, i.e., OT#1 or no OT#1, the Maintenance Test Support Package, and Reliability Assessments. However, he believed the common goal of developer and tester could be best met by reasonable willingness to be flexible and to communicate with one another.

However, concluded MG Kirwan, quoting the late GEN Abrams, "Basically no requirement is so urgent that we produce unsatisfactory equipment to fill it."

The question and answer period that followed again aired the concerns of the PMs over ways to improve and attain more reasonable and realistic test planning and execution.

MG Robert J. Lunn, director, Development and Engineering, HQ DARCOM, acquainted the group with some current trends in test and evaluation, paying particular attention to the probable impact of the draft DOD 5000.3 regulation. The changes that will be imposed by the new regulation will be, in MG Lunn's opinion, a new time-consuming hurdle.

New guidance on nondevelopmental items testing, product improvement testing and foreign test data, generated considerable discussion.

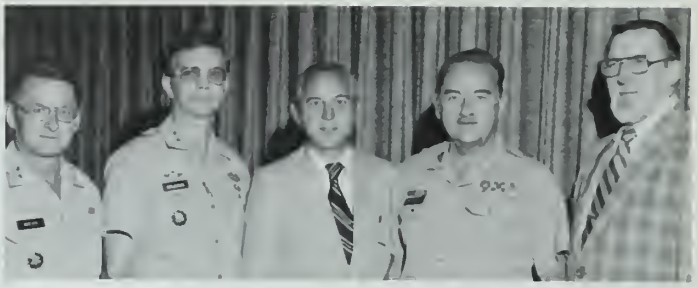
MG Lunn noted the serious problems facing TECOM in light of reduced personnel, lack of funds, and yet increasing demands for more detailed and complex testing.

MG Jerry R. Curry, commander, TECOM, followed by pointing out graphically the widening gap between demands and capability of TECOM. The possible solution of contracting out to take up the personnel loss is all too often taken to mean by the civilian community as relatable to a reduction in force. TECOM will solve the load by the level of effort currently attainable, and additionally, make these same people supervisory personnel to oversee contract testing. The tests subcontracted out will be carefully screened.

The guest speaker at the luncheon was Mr. Oliver C. Boileau, president, Boeing Aerospace. His remarks included his impressions of his experience as a member of the Defense Science Board summer study session that discussed RSI. He stressed his view that the European members of NATO had been able to rebuild themselves under the protection of a largely American financed defense shield. Now that these nations had achieved total postwar recovery, he felt it was time for them to accept a great share of the economic costs of NATO, and a recommitment by all the NATO powers to the purposes of the organization.

The final presentations of the conference included an update by MG Lunn on the FY79 RDTE funding program, and a review of the status of the "Skill Performance Aids" program—formerly known as ITDT; "How to Handle Funds" by COL Richard D. Kenyon, PM, Blackhawk; "Evaluation and Electro-Optical Systems in Degraded Visibility Conditions" by COL Henry R. Shelton, PM, SMOKE; "Skilled Works Approach" by COL Leonard S. Marrella, PM, DIVADS; "PM Interface With Logistics Control Agency—LIF" By COL Robert W. Wagers, commander, LCA; "NAVCON—Position Navigation Systems—TRADOC TSM Interface" by COL LeRoy White, PM, NAVCON; and finally COL Lauris M. Eek Jr. chief, Office of Project Manager, HQ DARCOM, discussed "Project Management—Issues."

Following an executive session, the conference was adjourned.



PARTICIPANTS at the first meeting of the DARCOM Modernized Army Research and Development Information System (MARDIS) Functional Coordinating Group included (l. to r.) COL Richard L. Nidever, chief, RDTE Programs and Budget Division, Office Deputy Chief of Staff for Research, Development and Acquisition; COL W. A. Coleman, director, Financial Systems Directorate, U.S. Army Computer Systems Command; Samuel M. Esposito, chief, Technical Programs Division, Plans, Programs and Analysis Directorate, U.S. Army Communications R&D Command; COL Earl R. Weidner Jr., chief of Staff, CORADCOM; and Robert F. Chaillet, chairman, DARCOM MARDIS Functional Coordinating Group. Convened at HQ CORADCOM, Fort Monmouth, NJ, the meeting was comprised of formal and informal discussions related to progress and problems of the MARDIS program. COL Nidever, whose byline article on programing and budgeting appears in the September-October issue of the Army RDA Magazine, was the keynote speaker.

DOD Schedules High Energy Laser Conference

A Department of Defense secret level conference on High Energy Laser Technology will be held 24-26 April at the Naval Post Graduate School, Monterey, CA.

This third biannual conference will be hosted by the U.S. Army in conjunction with Defense Advanced Research Projects Agency, Office of the Secretary of Defense, the Air Force and the Navy. The Army High Energy Laser Center (Provisional), U.S. Army Missile Research and Development Command, has responsibility for overall administration.

Objective of the conference is to provide a forum for the controlled presentation of classified information on the state-of-the-art in all major areas of R&D associated with the High Energy Laser Program.

The meeting will emphasize technology achievement in the last two years and feature information in propagation, effects, vulnerability, systems, subsystems and field demonstrations.

Interested individuals possessing appropriate security clearances and need-to-know can contact the Army High Energy Laser Center, Redstone Arsenal, AL 35809, or call AC 205, 876-3495 (Autovon 746-3495).

In Brief . . .

Assistant Secretary of the Army (RDA) Percy A. Pierre (Systems Acquisition Management Conference, Washington, DC)

Members of the American Institute of Industrial Engineers, who attended a recent Systems Acquisition Management Conference, heard Assistant Secretary of the Army (Research, Development, and Acquisition) Percy A. Pierre discuss the topic "NATO Impact of Systems Acquisitions."

Meeting at the Twin Bridges Marriott, Washington, DC, on 25 Sept., the group heard Dr. Pierre describe the origins of the renewed efforts at standardization and interoperability, its objectives and problem areas, and some of the actions being taken in furtherance of these objectives.

"Standardization and interoperability are but two . . . objectives." Not only is the goal one of greater efficiency on the battlefield, but also more effective use of shared resources, more rapid exploitation of technology by cooperative effort, and the meeting of political, social, and economic objectives.

Dr. Pierre cautioned the audience that multinational development of requirements will be a difficult task due to diversity in experience, perception, and language. He cited the example of the new General Support Rocket System as being one where such

differences have occurred, but the requirement is being defined so that multinational needs can be met by a single system.

The Culver-Nunn Amendment, he noted, "provides that it is U.S. policy that equipment procured for U.S. use in Europe shall be standardized or at least interoperable with the equipment of other members of NATO." The Army's requirements determination process supports this policy. Foreign systems, said the Secretary, are considered throughout the acquisition process. Even when a decision is made to begin American development, foreign systems are often considered as alternatives at each milestone of the program. Rejection of a foreign system may not be due to technical performance, rather a matter of timing—the relative states of development of competing systems.

The source selection process, Pierre noted, is a well defined one, but when the Army is asked to consider offers outside the normal source selection process problems may arise due to such things as lack of comparable data, lack of data, differences in interpretation, etc.

There are also factors beyond the Army's control in the procurement of foreign items should they be selected for adoption. Despite strong Congressional support for standardization and interoperability, "there are numerous competing policies contained in both statute and regulation . . . which impact . . . on U.S. Army efforts to achieve standardization with NATO.

"Direct U.S. purchases of foreign systems must also consider the impact on social and economic policies such as the preference for contract awards to U.S. contractors who will perform in a domestic labor surplus area; the preference for awards for small business, the balance of payments program . . ." Citing the case of the MAG-58 machinegun procurement from a foreign developer, the impact was softened by a coproduction arrangement.

The use of coproduction, licensing, cooperative research and development, can lessen the procurement obstacles, but, said the Secretary, a great deal more cooperation and coordination will be needed than has heretofore been experienced.

Dr. Pierre concluded by saying that "until the real nuts and bolts issues of materiel acquisition, such as I confront each day, are rationalized with the objectives we are setting for the Alliance," the soughtfor added payoffs of closer cooperation and unified goals will be hard to attain. "This rationalization can begin at the top but it must come from the bottom, from the users, developers, analysts and our representatives who face each other . . ."

Commander, U.S. Army Materiel Development and Readiness Command, GEN John R. Guthrie (Advanced Planning Briefing for Industry, U.S. Military Academy, West Point, NY)

Commander of the U.S. Army Materiel Development and Readiness Command GEN John R. Guthrie was the recent keynote speaker during an Advanced Planning Briefing for Industry at the U.S. Military Academy, West Point, NY. His presentation on the challenge of planning for materiel acquisition contained numerous statements of policy.

GEN Guthrie stated at the outset that our Armed Forces cannot be expected to defeat a numerically superior enemy unless they have the hardware to do the job. Getting the hardware to the soldier, he said, is the real challenge of materiel acquisition.

He emphasized, however, that our greatest weakness in the acquisition process continues to be the length of time it takes to actually acquire new systems, and despite all of DOD's experience in the acquisition field we are still far from having a fool-proof scheme for developing military hardware. Said Guthrie: "the complexity and sophistication of new systems grow apace with improvements we make."

The DARCOM commander noted that although the Army knows how the acquisition process should work, the Army seems to have trouble in building a consensus on needed performance requirements. Even after development begins, he noted, we too often fail to maintain the consensus requirements we have established. He maintained that once a decision is made, everyone should set aside their differences and support it.

The General indicated that another problem in the acquisition process is that sometimes the state-of-the-art is pressed too finely and we end up with systems that work only in the laboratory or are much too complex. He cautioned against painting a too rose-colored, over optimistic picture about current capabilities.

If the Army's R&D program is to be successful, noted Guthrie, it must be stable, adequately funded, and be capable of execution during the time programed. He added that R&D, by definition, is a risk business and that it is unrealistic to insist on 100 percent success. The real maturity of a system, he emphasized, is achieved through troop use.

Everyone from the soldier in the field to the engineer who designed the system, explained Guthrie, must be prepared to experience minor or unanticipated problems and must recognize that he or she has an essential role to play in identifying and correcting such problems. He qualified this by saying that he did not expect acceptance of a system that did not work.

Expanding on this, Guthrie stressed that when an attempt is made to get 100 percent perfection, it threatens to increase purely administrative lead times to the point where they exceed the technical development and production lead times. This has resulted in a loss of flexibility in the fielding of our systems.

The DARCOM commander reemphasized that the greatest problem in developing new equipment is time. He cautioned against falling behind the Soviets and having to play "catch-up ball" as has been necessary in the past.

Two key points were suggested by the General to avoid falling behind the Soviets. First, he called on industry to play a greater role in the R&D process. This is necessary, he said, because DARCOM's in-house resources are diminishing. Scientists and engineers are taking employment with industry, universities, and other government agencies outside of DARCOM.

Guthrie candidly stated that "we cannot recruit an adequate number of new personnel to fill our ranks. More and more we must turn to industry to help supply the basic knowledge to develop new systems."

Secondly, the General noted that industry and the Army must become tougher managers of people, money, and time. He referred to a statement by Under Secretary of Defense (R&E) Dr. William Perry that managers must stand up and make hard decisions relative to what programs should be cancelled and which ones are worthy of continuing.

Guthrie concluded with an appeal to industry and the military services not to abrogate their responsibilities for providing complete and factual information on technological developments and stabilizing requirements formulation.

Commander, U.S. Army Training and Doctrine Command, GEN Donn A. Starry, Advanced Planning Briefing for Industry (U.S. Military Academy, West Point, NY)

Commander of the U.S. Army Training and Doctrine Command GEN Donn A. Starry recently presented a dinner address at an Advanced Planning Briefing for Industry, hosted by the U.S. Military Academy, West Point, NY. His address on "How to Improve the Military Capability of the NATO Alliance" dealt primarily with the much talked about topic of Rationalization, Standardization and Interoperability. A summary follows:

GEN Starry began his address by stating that Rationalization, Standardization and Interoperability (RSI)—depending on the speaker—can be treated as a disease, a fad, a religion, or a cure for the common cold. He sought to explain how the Army perceives it and what they are doing about it.

The "R" in RSI, noted the General, is too often given lip service and considered only in terms of hardware developments, services, or supply matters. However, it is in fact a cardinal concept and implies a logical reasoning process, he said.

Rationalization, he added, produces common operational concepts which provide for joint development of tactics, hardware, services, procedures, organization and training systems.

Relative to TRADOC's mission, stressed Starry, rationalization simply means that common operational concepts must be developed in the context of the NATO coalition. The nature of coalition warfare must be added to the considerations of services, supply, and operational cooperation. He emphasized that rationalization is considerably more than a series of agreements to buy something from the other fellow.

The most widely publicized but least understood part of RSI, said the TRADOC commander, is standardization, or the process

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(Continued from page 31)

of developing and using the same or common weapons or hardware and software procedures.

Three essential components of standardization identified by Starry, are: a common resolve to achieve standardization; the technical ability to accomplish standardization; and the reconciliation of the materiel acquisition process in each country with demands imposed by standardization.

Starry noted that several key problems must be overcome if standardization is to be a serious endeavor. The NATO alliance should be aware that certain countries are technically ahead of others in certain areas. Stipulations about competitive development should be set aside in favor of using these technologies.

Other problems which must be addressed, according to the General, include differences in design philosophies, production plant methods and procedures, technology transfer, and the common resolve to standardize.

The process of materiel acquisition must also be considered because, said Starry, in most nations it is much more a product of nationally owned or subsidized plants that it is in the U.S.

Interoperability, the third component of the RSI concept, is the element which deals with the services that can be provided or accepted by members of the NATO coalition. "In the opinion of many observers," said Starry, "interoperability is the most promising part of RSI because it can be had at little or no cost.

"It should be aparent that we believe interoperability in NATO offers the greatest potential for improvement. Although it can be many things to many people, its most important elements are common use of bulk commodities, common operating protocols and procedures, and software."

Starry concluded his remarks by stressing the following guidelines which might be followed in pursuing RSI:

- Declarations alone don't rationalize anything, they must be backed by a firm and active resolve.
- Rationalization, in its full context, calls for early agreement on military operational concepts.
- Rationalization cannot be had unless we improve our technical capability to achieve rationalization.
- Rationalization in NATO must be based on common long-range equipment plans.
- Relative to money, there is a need to develop the many ways in which common development of materiel can be funded.
- There is more to be gained through interoperability than standardization. While less exotic than weapon system standardization, it is nonetheless the area of greatest potential payoff.

Deputy Chief of Staff for Research, Development, and Acquisition LTG Donald R. Keith (*American Defense Preparedness Association Meeting, Fort Knox, KY*)

LTG Donald R. Keith, in addressing an American Defense Preparedness Association meeting at Fort Knox, KY, told the group that continued support of the Army's drive to re-equip itself with modern materiel would need public understanding and support.

Keith, the Army's Deputy Chief of Staff for Research, Development, and Acquisition, noted that Congressional support to date has been excellent. The Army's $2.7 billion RDTE budget request answers much of the needs in that area. However, the general continued, FY79 is a transition year for many of the Army's major new systems. The procurement request for this year, he noted, was about $6.6 billion, up $1 billion from last year. "I can guarantee you that in the next five or six years the sums involved will draw immediate and focused attention"

Competition for defense dollars among the Services will be more keen, as each Service is in the process of a costly modernization effort. "I think our best approach is to lay the case for a modern Army before whomever will listen and trust the judgment of the decision makers."

However, Keith pointed out that in doing this, the Army should do all it can to see that its story is correctly and accurately told. He cited the arguments that the 1973 war proved the tank cannot live on the modern battlefield. On the contrary, what that war did show, he continued, was "that ground warfare must be a combined arms effort if it is to be successful. The tank, if anything, is more citical on the battlefield than it has ever been." The role of and need for the new Infantry Fighting Vehicle was another example where the general felt greater understanding was required.

The other Services can point to slick looking new Soviet aircraft and naval vessels and the effect can be dramatic. The Army shows a picture of the new Soviet T-72 tank, and to most people, it looks no different that its predecessor. To a public accustomed to hearing about MIRVs, ICBMs, cruise missiles, and new carriers, the Army's personnel carriers, artillery pieces, and tanks do not elicit the same degree of excitement or understanding.

In looking at itself, Keith said, the Army must "execute our programs and formulate our requirements with self discipline and corporate maturity." The nice-to-have, and the duplicative programs must be eliminated, along with indecisiveness and altering of requirement . . .

Awards . . .

WRAIR Presents Annual Hoff Memorial Medal



HOFF MEMORIAL MEDAL is presented to MAJ Brian G. Schuster (right) by COL Robert J. T. Joy, chairman, Department of Military Medicine and History, Uniformed Services University of Health Sciences.

MAJ Brian G. Schuster, MC, was recently presented the Hoff Memorial Medal for achievements as the outstanding graduate of Walter Reed Army Institute of Research's Military Medical Sciences Course.

Presented annually since 1902, the award was established through an 1897 endowment by COL John Van Renssalaer Hoff in honor of his father COL Alexander H. Hoff. Both are noted for distinguished careers in the Army Medical Service.

Schuster, now assigned to WRAIR's Division of Experimental Therapeutics, was cited for his course work titled "The Immunogenicity of Liposomes Containing Lipid A." He earned his M.D. degree from University of Miami.

Board Certified in internal medicine, he also completed his medical residency at Walter Reed Army Medical Center, and is a member of the American College of Clinical Pharmacology and an associate in the American College of Physicians.

Personnel Actions . . .

Vinson Named RDA Assistant Deputy Chief of Staff



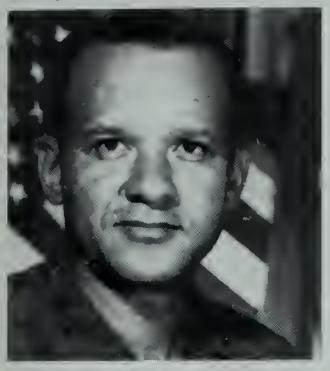
Assistant Deputy Chief of Staff for Research, Development and Acquisition and Assistant Deputy Chief of Staff for RDA (International Progams) are new titles assumed by MG Wilbur H. Vinson Jr., former director of Weapons Systems, ODCSRDA.

Graduated from the U.S. Military Academy with a BS degree in military science, MG Vinson earned an MS degree in mechanical engineering from the University of Southern California, and has completed the Command and General Staff College, National War College, and Artillery School courses.

From 1975-77 he served as deputy chief of staff for Combat Development, U.S. Army Training and Doctrine Command, following a tour of duty as commander, U.S. Army Southern European Task Force and Support Group, Italy.

Assignments during 1971-73 in the Office of the Army Chief of Research and Development included director, Plans and Programs and deputy chief of R&D (International Programs), and director of Missiles and Space. MG Vinson commanded I Corps (Group) Artillery, Eighth U.S. Army, Pacific-Korea from 1970-71, following a brief tour as commander, Division Artillery, 2d Armored Division, Fort Hood, TX.

Curry Takes Over Test and Evaluation Command



MG Jerry R. Curry

MG Jerry R. Curry, former assistant division commander of Support, 4th Infantry Division (Mechanized), Fort Carson, CO, is the new commander of the U.S. Army Test and Evaluation Command, following the retirement of MG Patrick W. Powers.

A veteran of more than 25 years of military service, MG Curry holds a BE degree in general education (foreign language) from the University of Nebraska-Omaha, and a master's degree in international relations from Boston University.

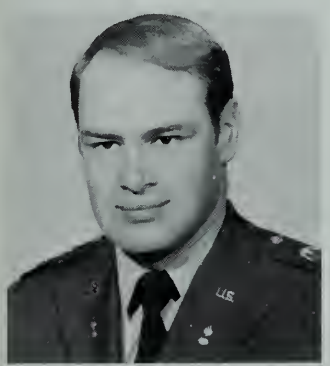
His military schooling includes the basic and advanced courses at the U.S. Army Infantry School, the Army Command and General Staff College, and the U.S. Army War College.

During 1976-77, MG Curry served as deputy commander of the U.S. Army Military District of Washington, DC, following tours of duty as deputy chief of staff and chief of staff, V Corps, U.S. Army Europe. He also commanded the 3d Brigade, 8th Infantry Division, U.S. Army Europe briefly in 1975.

Other key assignments have included operations research analyst, Program Group, Planning and Programming Analysis Directorate, Office, Assistant Vice Chief of Staff, DA, Washington, DC; and commander, Advisory Team 22, U.S. Military Assistance Command, Vietnam.

MG Curry is a recipient of the Legion of Merit with Oak Leaf Cluster, Bronze Star Medal, Meritorious Service Medal with OLC, Air Medals, Army Commendation Medal with two OLC, Navy Commendation Medal, Combat Infantryman Badge, Parachutist Badge, and Master Army Aviator Badge.

Watervliet Gets New Commander, Deputy CO



COL Robert W. Pointer



LTC Joseph M. DeChant

COL Robert W. Pointer Jr. has assumed command of Watervliet (NY) Arsenal, succeeding COL Church M. Matthews Jr., who has been assigned as project manager for the Viper missile system, Redstone Arsenal, AL.

Coincidentally, LTC Joseph M. DeChant, former supply representative with the U.S. Army Engineer Division Mideast, Saudi Arabia, has joined COL Pointer as Watervliet Arsenal deputy commander.

Graduated from the U.S. Military Academy in 1958, COL Pointer holds a master's degree in mechanical engineering from New Mexico State University, and has completed the Field Artillery and Air Defense Artillery Basic Courses, and the Ordnance Advanced Course.

Prior to coming to Watervliet Arsenal, he was product manager of Heavy Equipment Transporter Systems at Warren, MI. Other recent assignments included commander, 43d Support Group, Fort Carson, CO; and weapons director, Office, Deputy Chief of Staff for Logistics, DA.

COL Pointer has served also at Fort Riley, KS, in the Republic of Vietnam and Germany, and at White Sands Missile Range, NM. He wears the Legion of Merit, Bronze Star Medal with Oak Leaf Cluster (OLC), Meritorious Service Medal with OLC, and the Army Commendation Medal with two OLC.

LTC DeChant, also a 1958 graduate of the U.S. Military Academy, has a master's degree in management from Webster College, and has completed the Ordnance Advanced Course, the Basic Infantry Officer Course and Airborne School, and the nonresident Army Command and General Staff College.

During 1971-74, he served with the U.S. Army Materiel Management Agency, Zweibrucken, Germany, following earlier assignments as a logistics staff officer and post maintenance officer, Fort Eustis, VA, and logistics staff officer, U.S. Army, Republic of Vietnam.

LTC DeChant also served during 1974 as executive officer for the Research, Development and Engineering Directorate at the U.S. Army Tank-Automotive Command, Warren, MI. He is a recipient of the Bronze Star Medal, Meritorious Service Medal, and the Army Commendation Medal.

Konopnicki Departs DARCOM for DCSLOG Assignment



MG Emil L. Konopnicki

MG Emil L. Konopnicki, director of Readiness, U.S. Army Materiel Development and Readiness Command since 1977, has assumed new duties as assistant deputy chief of staff for Logistics, Department of the Army, Washington, DC.

Graduated with a BS degree in military science from the University of Maryland and an MBA degree in business administration from Babson Institute, MG Konopnicki has also completed requirements at the Command and General Staff College, Industrial College of the Armed Forces, and the Army Ordnance and Armor Schools.

During more than 30 years of active military service, he has served assignments as assistant chief of staff, G-4, Eighth U.S. Army, and assistant chief of staff, J-4, United Nations Command/United States Forces, Korea; deputy director, Supply and Maintenance Directorate, Office, Deputy Chief of Staff for Logistics, U.S. Army; and deputy director, Supply and Maintenance Directorate, DCSLOG.

Listed among his other key career assignments are commander, 26th General Support Group, U.S. Army, Pacific-Vietnam, and plans officer, later head, Logistics Plans Section, Logistics Plans and Policy Branch, J-4 Division, Pacific Command, Camp H. M. Smith, Hawaii.

MG Konopnicki is a recipient of the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with "V" Device and three OLC, Air Medal, Army Commendation Medal with two OLC, and the Senior Parachutist Badge.

Wray Heads New Chief of Engineers Directorate



MG William R. Wray

MG William R. Wray, former assistant chief of the Army Corps of Engineers, assumed duties in October as head of the newly created Directorate of Military Programs in the Office of the Chief of Engineers, Washington, DC.

The new directorate, which combines responsibilities for programing and budgeting, acquiring, operating and maintaining real property facilities under one senior Engineer general officer, replaces the former Directo-

rates of Military Construction and Facilities Engineering.

MG Wray is a 1946 graduate of the U.S. Military Academy, and holds a master's degree in civil engineering from Texas A&M. He has also completed course requirements at the Army Command and General Staff College and the National War College.

In 1974, he was selected at the first director of Facilities Engineering in the Office of the Chief of Engineers, following earlier duty in that same office as deputy director of the Military Construction Directorate.

Included among his other key assignments are tours in the Systems Directorate, Office, Assistant Chief of Staff for Force Development; commander, 169th Engineer Construction Battalion, Vietnam; and commander, 35th Engineer Construction Group and director of Construction, Engineer Command, Vietnam.

A registered professional engineer in the District of Columbia, MG Wray is a recipient of the Legion of Merit with two OLC, Bronze Star Medal with OLC, Meritorious Service Medal, Air Medal with OLC, Joint Service Commendation Medal, and the Army Commendation Medal.

Skibbie Joins Office Deputy Chief of Staff (RDA)



BG Lawrence F. Skibbie

BG Lawrence F. Skibbie, former deputy commander for Ammunition Readiness, U.S. Army Armament Materiel Readiness Command, Rock Island Arsenal, IL, is the new deputy director, Materiel Plans and Programs, Office of the Deputy Chief of Staff for Research, Development and Acquisition, Washington, DC.

A veteran of more than 24 years of active military service, BG Skibbie is a graduate of the U.S. Military Academy and holds an MS degree in mechanical engineering from New Mexico State University. He has completed the Command and General Staff College, ICAF, and the Ordnance School basic and advanced courses.

During 1975-77, he commanded Rock Island Arsenal, Rock Island, IL, following earlier tours as chief, Program Management Division, Office, Project Manager for Munitions Production Base Modernization and Expansion, Dover, NJ, and R&D coordinator, Systems Integration Analysis Directorate, U.S. Army Concepts Analysis Agency, Bethesda, MD.

Other key assignments have included operations research analyst, Artillery Systems Group, Weapons Systems Analysis Directorate, Office, Assistant Vice Chief of Staff, Department of the Army; and executive officer, Cost Analysis Directorate, Office, Comptroller of the Army.

BG Skibbie is a recipient of the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal, Meritorious Service Medal with OLC, Air Medal, and the Army Commendation Medal with three OLC.

Lilley Picked as TSARCOM Deputy Commander

Taking over as deputy commander of the U.S. Troop Support and Aviation Materiel Readiness Command, St. Louis, MO, is BG Aaron L. Lilley Jr. He is leaving the assignment as deputy chief of staff for Logistics, First U.S. Army, Fort George G. Meade.

Before his assignment at Fort Meade, BG Lilley had commanded the Division Support Command, 1st Cavalry Division, Fort Hood, TX. This followed a tour in the Office, Deputy Chief of Staff for Logistics, U.S. Army, Washington, DC, as chief of the Strategic Mobility and Policy Division.

During an earlier assignment in the Office of the Deputy Chief of Staff for Logistics BG Lilley served as an aviation program officer, and later as chief of the Programs, Resources and Readiness Office. In 1968-70 he commanded the 1st Transportation Battalion, U.S. Navy Ship, Corpus Christi Bay, U.S. Army Pacific-Vietnam.

BG Lilley holds a BS degree in business administration from St. Benedict's College and an MS degree in contract and procurement from Florida Institute of Technology. He has completed the Command and General Staff College, the Industrial College of the Armed Forces, and the Aviation and Transportation Schools.



BG Aaron L. Lilley

Included among his military awards and decorations are the Legion of Merit with Oak Leaf Cluster (OLC), Distinguished Flying Cross, Bronze Star Medal with two OLC, Meritorious Service Medal, Air Medals, and the Army Commendation Medal with OLC.

Davis Succeeds Rider as Yuma PG Commander

COL James M. Davis Jr. recently succeeded COL James D. Rider as commander of Yuma Proving Ground, AZ, following a tour of duty since 1975 as commandant of the U.S. Military Academy Preparatory School, Fort Monmouth, NJ.

A 1958 graduate of the U.S. Military Academy, COL Davis holds a master's degree in mechanical engineering from Georgia Institute, and has completed requirements at the Command and General Staff College, and the Army War College.



COL James M. Davis

Listed among his earlier career assignments are project monitor, Air Mobile Division, Office, Chief of Research and Development, Department of the Army; and staff officer, War Plans Division, Office, Deputy Chief of Staff of Operations, U.S. Army Europe, Heidelberg, Germany.

COL Davis has also served tours in Vietnam as chief of staff, 2d Brigade; executive officer and acting chief of staff, 1st Infantry Division; and training officer, Bien Hoa Tactical Area Command, Second Field Forces.

His military awards include the Legion of Merit, Bronze Star Medal, Meritorious Service Medal, Army Commendation Medal with two Oak Leaf Clusters, and the Combat Infantryman's Badge.

Lang Chosen as New CERCOM Deputy Commander

Deputy Commanding General U.S. Army Communications and Electronics Materiel Readiness Command, Fort Monmouth, NJ, is the new title of BG Vaughn O. Lang. He has served since 1976 as assistant deputy director for Command and Control and Telecommunications, J-3, Organization, Joint Chiefs of Staff, Washington, DC.



BG Vaughn O. Lang

BG Lang holds a BA degree in accounting and auditing from Pennsylvania State University and an MBA degree in business administration from the University of Arizona. His military schooling includes the Army Command and General Staff College, Industrial College of the Armed Forces, and the Signal School (basic and advanced).

Preceding an assignment (1974-76) as commander of the 1st

Signal Brigade in Korea, BG Lang had served tours in the Office, Assistant Secretary of the Army (Installations and Logistics) as assistant to the Deputy for Materiel Acquisition and as assistant deputy for Materiel Acquisition.

Other key assignments have included commander, 39th Signal Battalion, U.S. Army Strategic Communications Command, U.S. Army, Pacific-Vietnam; and executive to Assistant Deputy Chief of Staff, Logistics for Programs and Budget and Director of Materiel Acquisition, Office, Deputy Chief of Staff for Logistics.

BG Lang wears the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with OLC, Meritorious Service Medal, Army Commendation Medal with two OLC, and Parachutist Badge.

Zeidner Selected as Army Chief Psychologist

Dr. Joseph Zeidner has been appointed chief psychologist of the Army and technical director of the Army Research Institute for the Behavioral and Social Sciences (ARI), following service since 1972 as director of ARI's Organizations and Systems Research Laboratory.

He succeeds Dr. J. E. Uhlaner who, until his retirement in February 1978, had served since 1971 as the Army's chief psychologist and since 1972 as technical director of ARI. The ARI technical director administers an annual $22 million program of basic and advanced research related to the psychological and social sciences.

During his 28 years in Army psychology Dr. Zeidner has served as ARI deputy director for Manned Systems Research, and principal deputy director and chief of the Support Systems Research Division. He has also been a liaison scientist for the U.S. Office of Naval Research in London, England, and lecturer at Howard University.

A Fellow of the American Psychological Association and an author of books and reports on psychological testing, Dr. Zeidner holds a bachelor's degree from the City College of New York, an MA degree from Fordham University, and a PhD from the Catholic University of America.

In 1963, Dr. Zeidner was nominated for the Arthur S. Fleming Award for the Outstanding Young Man in Federal Service, and in 1978 he received the Department of the Army Decoration for Exceptional Civilian Service in recognition of effective technology achievements.



Dr. Joseph Zeidner

Grabau Named to London Standardization Group

Warren E. Grabau, a special assistant in the Environmental Laboratory at the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, has been appointed to the U.S. Army Research and Standardization Group, London, England.

As a successor to Dr. Hoyt Lemons, Grabau will provide technical liaison between Europe and the U.S. for the Army Corps of Engineers. One of the requirements for the position is a broad background in the natural sciences.

Grabau, who has a master's degree in geology from Michigan State University, was recommended for the position by COL Maxim I. Kovel, acting chief of the Corps of Engineers' R&D Office. Chief of Engineers LTG John W. Morris confirmed the selection.

An active member of various international organizations, Grabau was employed as a consulting engineering geologist and a military geologist with the U.S. Geological Survey prior to joining the WES staff in 1956. He has directed studies related to soils, terrain analysis, and mobility and environmental factors.



Warren E. Grabau

Magee Chosen as Tilt Rotor Aircraft Deputy PM



John P. Magee

John Patrick Magee was named deputy project manager (technical) for the Tilt Rotor Research Aircraft Project Office, Aeromechanics Laboratory, U.S. Army Research and Technology Laboratories, AVRADCOM, NASA Ames Research Center, Moffett Field, CA.

Prior to joining the Aeromechanics Laboratory, Magee was program manager of Boeing Vertol Co.'s Tilt Rotor Program. Other Boeing assignments have included project engineer, Tilt Rotor Program, group leader, Tilt-Stowed Rotor Technology, and engineer, Aeronautics Research Group.

A 1963 graduate of Loughborough University, Loughborough, Leics, England, Magee has authored or coauthored about 30 technical papers and reports, in addition to proposal documents and interim reports. He received a Certificate of Recognition for NASA Ames Research Center in 1975 for creative development of technology for work on Tilt Rotor feedback controls during 1971-73.

Devereaux Commands Cold Regions Laboratory

LTC Alfred B. Devereaux Jr. was recently assigned as the commander and director of the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH. He is a 1978 graduate of the Army War College, Carlisle, PA.

LTC Devereaux has previously served as commander and director of the U.S. Army Engineer Topographic Laboratory at Fort Belvoir, VA. He was also commander of the 649th Engineer Battalion in Germany. Other assignments have been Washington, DC, Vietnam and Korea.

Graduated from the U.S. Military Academy in 1959, he has an MS and a PhD in geodetic science from Ohio State University. He also attended the U.S. Army Command and General Staff College.

LTC Devereaux is a recipient of the Legion of Merit, Meritorious Service Medal with one Oak Leaf Cluster, the Bronze Star Medal and the Army Commendation Medal.

Gelnovatch Appointed Division Chief at ERADCOM

Mr. Vladimir G. Gelnovatch, a supervisory electronic engineer, has been appointed as chief, Microwave and Signal Processing Devices Division, Electronics Technology and Devices Laboratory, U.S. Army Electronics R&S Command, Fort Monmouth, NJ.

Nationally renown in the microwave community for contributions in the field of microwave integrated circuits and computer aided design, Gelnovatch was a 1972 recipient of an Army R&D Achievement Award for development of the "DEMON" computer program. This program is now used widely in the U.S. and Europe for automatic design of microwave integrated circuits.

Graduated with a BS degree from Monmouth College and an MSEE degree from New York University, he is a contributing author to a book titled *Advances in Microwaves* (Vol. 8) and has published more than 40 technical papers.

Additionally, he is associate editor of the *Microwave Journal*, a member of the Solid State Circuits Council of the Institute of Electrical and Electronics Engineers, and has served as a participant in a scientific exchange program between the U.S. and the Soviet Union.



Vladimir G. Gelnovatch

'VuPoints'

To the Editor:

This makes the second time that I've seen the "Solar Cost Effectiveness Questioned" article by Dr. Oskar M. Essenwanger appear in an official Army publication. In my opinion, it casts a negative shadow on solar energy and I think your reading public ought to be exposed to the other side of the coin.

The irony of the article is that: like it or not, we all live in solar-heated dwellings. Ninety-five percent of our daily heating energy needs come from the sun's rays. If the sun were to stop shining tomorrow, in a short period of time our dwellings would be at −400°F. When our furnaces turned on and it would take a significant chunk of energy to heat them up to comfort zone temperatures of 68 to 70°F.

Dr. Essenwanger's economics fail to consider existing and potential tax incentives that practically cover the cost of solar hot water heating systems and can get home owners well on the way towards solar systems for space (comfort) heat. The payback period starts the day you turn on a system.

I have personally installed a 5-panel solar hot water heating system. A $400 HUD grant and a Harford County, MD, property tax incentive provides practically enough money to cover the system cost. The Federal income tax credit that has been approved by the Senate and has excellent prospects for governmental approval will help even further and perhaps get me started towards a solar space heating system.

Although my system has an electric back-up system, it has not been turned on since 21 Aug. 1978, the day I put the system into operation. It appears from my monthly gas and electric bill that I just received, fuel savings will be on the order of $30. Sixty percent of the days from the 21st of August to the end of the month were cloudy.

The essential theme of Dr. Essenwanger's article, the need for considering climatic conditions during system design is almost undermined by the extremes he goes to diminish solar energy. He makes a point that it even rained on a "sun day." Seems like he should have used his sophisticated climatic model to give an objective statement of national weather conditions or at least a statement that the sun also shined in many parts of the nation on "sun day." He claims that a 27- day storage capacity is needed for homes in the Huntsville area. Is that for a 100 percent solar system? To cover a 27-day period of consecutive cloudiness? To provide a 100 percent recovery rate? These are but a few of the questions that he leaves unanswered.

Why does he feel and attempt to convince us that solar energy has to provide for all (100 percent) of our heating energy needs to be "cost effective?" When I stated my rebuttal I told you that 95 percent of our heating energy comes from the sun. With existing solar technology and Dr. Essenwanger's climatic data we can wrestle 4 more percentage points for a total of 99 percent.

I don't think anyone would talk down solar energy for a silly percentage point, especially since the cost of conventional fuels are skyrocketing and "three days worth of the energy received from the sun is equivalent to the energy in all the world's fossil fuels." (J. Cousteau)

Sincerely yours,
JOHN F. McKITTRICK
Operations Research Analyst
U.S. Army Test and Evaluation Command,
APG, MD

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on . . .

Defense Supply Gains Operational Control of DDC

Operational control of the Defense Documentation Center passed from the Air Force to the Defense Supply Agency, effective Nov. 1. Management control remained under Defense Director of Technical Information Walter M. Carlson, Office of the Director of Defense Research and Engineering.

Dr. Robert B. Stegmaier Jr. took over as the DDC administrator after serving as staff assistant to Mr. Carlson for the past 10 months. COL James O. Vann, DDC commander since it was redesignated as the successor to the Armed Services Technical Information Center Mar. 27, 1963, was reassigned by the Air Force Systems Command.

Headquarters of the DDC at Cameron Station, VA, officially dedicated Sept. 18, 1963, was unaffected by the change of control. Headquarters of the Defense Supply Agency, under LTG Andrew T. McNamara was also located there at the time.

The Department of Defense announcement of the operational control change said it was designed to provide a direct channel of communication with which the DDC could function in its DOD-wide document services, and to insure a full range of services equally to all DOD components.

CRREL Sets New Headquarters Open House Nov. 21-23

The U.S. Army Cold Regions Research and Engineering Laboratory scheduled an open house program Nov. 21-23 to mark final acceptance of new headquarters and equipment at Hanover, NH.

Expected to attract many high ranking military leaders and a representation of cold regions research scientists and engineers from many parts of the Nation, the event also served to note attainment of CRREL's full-scale operation as a U.S. Army Materiel Command unit.

Organized as a consolidation of the Army's major cold regions research activities formerly located in Wilmette, IL, and Waltham, MA, CRREL is now situated on an 18-acre tract donated by Dartmouth College. The headquarters structure provides 72,000 square feet of space.

CRREL is assigned mission responsibilities for the conduct of basic and applied research and investigations in snow, ice and frozen ground, on and below the earth's surface, research in cold regions environments, and photographic interpretation research worldwide.

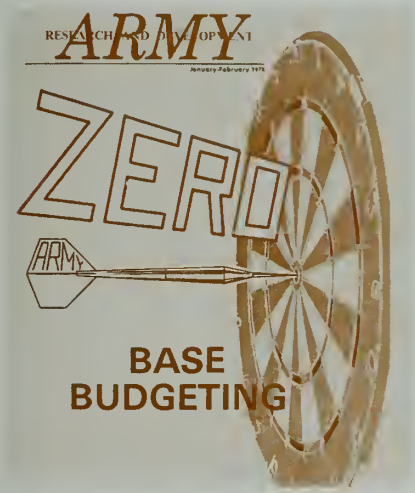
(Editors Note: The U.S. Army Materiel Command (now DARCOM) acquired CRREL from the Corps of Engineers as part of the massive consolidation of Army materiel activities in 1962, and redesignated it as the Terrestrial Sciences Center in July 1968. Transfer of control back to the Corps and redesignation of the activity back to CRREL, to its current status, was accomplished in July 1969)

Do you have something you want to say? Address your letters to: The Editor, Army RDA Magazine, U.S. Army Materiel Development and Readiness Command, ATTN: DRCDE-LN, 5001 Eisenhower Ave., Alexandria, VA 22333.

Annual Listing of Highlight Articles in Army RDA Magazine

The following headline list of articles published in the Army Research, Development and Acquisition Magazine (formerly Army R&D Newsmagazine) during the past year are believed to represent subjects of broadest interest to our readers.

JANUARY-FEBRUARY—



- Zero-Base Budgeting—How Does It Work? What's Different About It?
- Army Announces Reorganization Of Its Top Science Advisory Board.
- Conferees Evaluate Responsiveness Of DARCOM's Study Program Effort.
- Crystalline Hemoglobin Solution Foreseen As Blood Substitute.
- Commercial By Design—Changing Times And Changing Policies.
- 20 Years To Develop—The Remarkable Jeep Vehicle And Its History.
- The New Automated Engineering Document Preparation System Concept.
- Development Of Low-Maintenance Batteries For Military Requirements.
- Army Converts From Three Brake Fluids To One For Improved Service.
- Army Applied Technology Lab Studies Bearingless Main Rotor Concept.
- Human Engineering Lab Debuts Integrated Helicopter Control System.

MARCH-APRIL—



- Army Science Board Holds First Meeting As Successor To ASA Panel.
- FY 1979 Army RDA Budget Requests Submitted To Congress For Review.
- Interview With Assistant Secretary Of The Army (RDA) Percy Pierre.
- DARCOM Commander GEN Guthrie Addresses Senior Service Schools.
- Eustis Eyes Development Of Aerolastically Conformable Rotors.
- What's New In Advanced Aircraft Engine Development Technology.
- Soviets Work On Development Of Electrochemical Power For Vehicles.
- The Battlefield Exploitation And Target Acquisition Project.
- Photos Taken Of Red Square Weapons Parade On 7 November 1977.
- An Updated Report On U.S. Materials Research In The Tropics.
- Mobility Equipment R&D Command Collects Field Reliability Data.
- ADPA Sponsors Conference On A New Product Line: Training Systems.
- FY 1976 Army Materiel Acquisition Awards Recognize Achievements.

MAY-JUNE—



- DOD Compliance With OMB Acquisition Circular Is Topic Of Speech.
- DARCOM Commander GEN Guthrie Discusses Army Acquisition Policies.
- High Level RDA Officials Review Major Army Electronics Programs.
- Objectives Outlined In New Department Of The Army Energy Plan.
- MG Lunn Reflects On First 8 Months Duty As DARCOM D&E Director.
- Interview With DARCOM Assistant Deputy For International R&D.
- Wide-Angle Visual Systems For Military Training Applications.
- Army Regulation 95-20—The Virtually Unknown Aviation Regulation.
- Army Research Office Serves Many Requirements As Interface Agency.
- ARO Hosts Semiannual DARCOM Laboratory Directors Conference.
- DARCOM Laboratory Directors Review FY 1979 Basic Research Program.
- Army Logistics Study Office: What Is It and What Does It Do?
- DARCOM Commander Addresses Cost Performance Analysis Conference.

JULY-AUGUST—



- Atlanta V Conferees Discuss Major Materiel Acquisition Concerns.
- R&D Achievement Awards Recognize 75 Army Scientists and Engineers.
- The New Integrated Technical Documentation And Training Program.
- Exploratory Development Of The Unique Rifleman's Assault Weapon.
- Army Receives First SHF Tactical Satellite Communications Terminal.
- Army Science Conference Agenda Includes Awards, Look At The Future.
- 28th Power Sources Symposium Speakers Report On Latest R&D Progress.

SEPTEMBER-OCTOBER



- First Defense-Wide Technical Directors Conference Hosted At NBS.
- RDA Magazine Conducts Interview With LTG George Sammet, USA, Ret.
- Tank Development Traced To Royal Naval Air Service Early Efforts.
- Congressman Richard Ichord Reviews Role Of In-House R&D Laboratories.
- U.S. Department Of Defense Logistics Studies Information Exchange.
- Helicopter Fault Isolation Equipment Evaluated By Armed Services.
- Laser Induced Chemistry May Provide Solutions To Energy Problems.
- Army RDT&E And The Planning, Programing And Budgeting System.

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BLACK HAWK

